Exchange in Markets with Heterogeneous Agents and Trade Frictions

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Abstract

This thesis studies the implications of heterogeneity in consumers' incomes or preferences for market equilibrium and welfare in a world characterized by economies of scale and trade frictions.

The first chapter studies how the level and the distribution of per capita income affects industrial demand and thus the process of economic development in a closed economy, and the volume of international trade in an integrated world. In a closed economy with given aggregate GDP, countries with intermediate per capita income levels and population sizes have a larger number of industrial sectors than very rich and small or very poor and large countries. Furthermore, income inequality has a positive effect on the level of industrialization in poor economies, whereas the level of industrialization in rich economies is maximized by perfect equality. Finally, when international trade is possible, the volume of trade between two countries is increasing in the similarity of their per capita incomes.

The second chapter studies product selection by producers in markets where consumers have idiosyncratic preferences for different varieties of a good and have to search for their preferred variety. I show that the market share of the variety preferred by the majority is always higher than in a frictionless Walrasian market and increases with the severity of search frictions. For given search frictions, a consumer is better off when the group to which she belongs becomes larger, and, for given consumer group sizes, a fall in search frictions benefits minority consumers relatively more than majority consumers. I also study under what conditions mass consumption is a constrained-optimal outcome and the role played by the ability of producers to price discriminate.

The third chapter uses a standard monopolistically competitive model of international trade, in which countries have different preferences, to evaluate the often-heard argument that globalization endangers the culture of small countries. In the equilibrium of this model, an increase in economic integration considerably reduces the market share of the varieties typical of the culture of the small country. However, if integration is caused by a reduction in real transport costs, it nevertheless benefits consumers in this country. The model also shows that a country that is not too small relative to the dominant country can increase its welfare by adopting a limited level of trade protection, whereas for a very small country free trade is optimal. This model can be used to evaluate the economic implications of the principle of "cultural exception", invoked by France to protect its film industry.

Contents

List of Figures

Acknowledgments

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Cecilia Testa, Valentino Larcinese, and Andrea Caggese rarely opposed resistance to my suggesting a not-too-serious conversation over a late dinner, and in this and other ways they made me feel at home. Richard Walker did his best to refine my coarse understanding of the English language and way of life. I am sure I gave him good reasons to look back with horror at the results, but I hope that those tutorials were as enjoyable for him as they were for me. Christy Srisanan's cheerful and warm friendship has been very important to me, and I would like to especially thank her for her patience when my level of stress was soaring above the line.

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Introduction

Diversity occupies a central place in economics: it is arguably diversity in people's abilities and preferences, and the opportunities for trade that arise because of this diversity, that make economic theory an interesting and powerful discipline. One of the most remarkable achivements of neo-classical economics has indeed been to show how a decentralized market can thrive in the presence of diversity, by having the price mechanism co-ordinate the actions of a great number of heterogeneous agents and leading, under certain conditions, to the efficient use of scarce resources. In a neo-classical, perfectly competitive world, with no economies of scale in production and no imperfect information, not only can the market cope with diversity, but diversity is generally a good thing, as economic agents can benefit from specialization in production. This is for instance the case in the neo-classical theory of international trade, in which specialization according to comparative advantage allows countries to gain from trade. Furthermore, in such a perfectly competitive world, not only is diversity good for social welfare in the aggregate, but it also pays off for each single individual to be different: an agent is usually better off the more different from the rest of the population she is. In other words, an individual would usually like to differentiate her productive skills or her preferences over consumption alternatives from the rest of the population if given the opportunity to do so at a reasonable cost. For example, in a perfectly competitive labor market a worker can command a premium if she is one of few people to have some skills that are in short supply; or in a competitive market for final goods a consumer would like to be the only one to have a strong preference for a given good, as in equilibrium she would pay less for this good. However, although the neo-classical model of perfect competition is a useful benchmark for thinking about the way in which many markets work, an indiscriminate application of its conclusions would often lead to an over-statement of the advantages of diversity. In many real world situations, characterized by the existence of scale economies in production and of transport costs or search frictions in trade, the possibility arises that heterogeneity among participants in a market can indeed reduce the scope for trade and can make some agents with very peculiar characteristics worse off. The majority of this thesis is devoted to the theoretical study of instances in which these situations may arise.

More precisely, this thesis studies how the distribution across consumers of certain characteristics, such as per capita income and preferences, affects equilibrium outcomes in markets in which economies of scale in production or search frictions are important. In the remainder of this introduction I will give a brief account of the topics studied in the three chapters that follow, and will briefly clarify how the contribution presented in each of them relates to existing research. I refer the reader to the introduction and related literature section of each single chapter for a much more precise and detailed discussion of its contents.

Chapter 1 presents a model in which the level of demand – specifically, of demand for goods that can only be produced using increasing returns to scale technologies – plays a crucial role in determining the success or failure of industrialization in closed economies and the pattern and volume of international trade in an integrated world. In particular, I use this model to analyze the separate effects of average income, income distribution, and population size, first on the equilibrium number of industrial sectors in an economy in which international trade is prohibitively costly, and then on the pattern of specialization and the volume of trade in an integrated world. The observation that the extent of the market is a crucial factor for the successful industrialization of an economy is obviously not new, as it has occupied a central role in economics since Adam Smith's work. In most standard monopolistically competitive general equilibrium models which are now used to study these issues – see, e.g., Dixit and Stiglitz (1977), Spence (1976), and Krugman (1980) – the number of increasing returns to scale sectors of an economy increases with its market size, generally measured as the size of the labor force. However, these models are rather vague about the separate roles played by the size of the labor force in overcoming indivisibilities in production and in determining sufficient demand. In particular, they cannot analyze the separate channels through which population size, per capita income, and income distribution affect demand, because the type of consumers' preferences that they use poses no aggregation problem. i.e. market demand depends only on an economy's aggregate income. In these models there is no difference between a country with low per capita income and large population and a country with high per capita income and small population, provided that they have roughly the same aggregate GDP. Analogously, in these models income distribution plays no role in determining the extent of the market for industrial products, provided that aggregate GDP is held roughly constant. In other words, once the effect of aggregate GDP on industrialization has been controlled for, these models do not provide any insight into the role played by the level and the distribution of per capita income. In Chapter 1, by treating demand aggregation in more detail than in previous contributions, I present a more precise analysis of the relevant market for industrial products. In particular, I use a model in which individuals consume divisible amounts of food, produced under constant returns to scale, and possibly many industrial goods, produced under increasing returns to scale. Since the marginal utility of food is assumed to be decreasing and consumers are assumed to derive utility only from the first unit of each industrial good, the level and distribution of per capita income matter for demand, as richer consumers are willing to spend more of their income on industrial goods than poorer consumers. For given prices, higher average income is therefore conducive to more industrialization. However, in a closed economy with given aggregate GDP, higher average income also means a smaller population size and thus a higher average cost of production, which has a negative effect on industrialization.[1] I analyze how these two effects combine to determine the equilibrium number of industrial sectors for different levels of per capita income. I also show that income inequality reduces the number of industrial sectors in an already rich economy but could help jump-start the process of industrialization in poor economies.

The model presented here can also be fruitfully used to explain a well-known stylized fact in international economics. This is the observation that, contrary to the predictions of the standard Heckscher-Ohlin theory of international trade, over the last decades a large share of world trade has taken place between countries at similar stages of economic development and with rather similar factor endowments. The volume of trade among developed countries largely outweighs the volume of trade between the former group and developing countries. One of the first economists to present systematic evidence hereon was Linder (1961), who in his now classic study of these issues shows that the volume of trade between two countries is increasing in the similarity between their per capita incomes, even after controlling for their aggregate GDP. The explanation that he proposes, known as the Linder hypothesis, relies on the different demand structures of poor and rich countries: poor countries tend to consume many less product varieties than rich countries do and this severely limits the scope for trade between the former and the latter, as the varieties that are demanded in rich countries tend, at least in the first phases of the product cycle, to be

[1]Note that, throughout Chapter 1, I will keep aggregate GDP (but not necessarily per capita income and population size) constant, since, as mentioned above, the importance of total market size for industrialization has been already established in the existing literature.

produced there and traded only with other rich countries. The patterns of specialization and the predictions on the volume of trade implied by the Linder hypothesis arise naturally in the model of Chapter 1.

Chapter 2 studies markets in which consumer groups of different sizes have idiosyncratic preferences over differentiated goods and in which trade is characterized by search frictions. The analysis developed in this chapter is inspired by the effects that recent advances in telecommunication technologies, and especially the diffusion of the Internet, seem to have had on product markets. As a casual visit to one of the major on-line retailers of music CDs, books, or software reveals, the reduction in search costs between producers and consumers caused by the Internet has dramatically increased the availability of product varieties. In particular, it seems that a great number of varieties that appeal to small numbers of consumers have been introduced in the market. The fact that a reduction in search costs has increased the market share of products that appeal to minorities suggests that there could be a relationship between the level of search costs and the degree of diversity in consumption in a market economy. In particular, it seems to suggest that high search costs lead to an equilibrium in which producers specialize mostly, if not exclusively, in varieties that appeal to the tastes of large groups of consumers and overlook therefore the preferences of minorities. To address these issues, Chapter 2 presents a model of a market in which there are two groups of consumers with different sizes and with idiosyncratic preferences over two varieties of a differentiated good. Since consumers and producers have imperfect information about each other's location, trade is characterized by search frictions. In the equilibrium of this model, the market share of the variety preferred by a majority of consumers is always higher than in the frictionless Walrasian equilibrium and increases with the severity of search frictions. It can also be shown that, as a consequence of these properties of the equilibrium, a fall in search frictions benefits minority consumers relatively more than majority consumers. Furthermore, the model exhibits consumption externalities, in that an increase in the size of a group of consumers benefits each memebr of this group and damages the members of other groups. This happens because in this model the composition of production over-responds to changes in the composition of demand. Finally, the model can be used to evaluate the efficiency of the market equilibrium. For very severe search frictions the market outcome, characterized by very little diversity in production, is constrained optimal, whereas for lower levels of search frictions the market provides too little diversity compared to the optimal composition of production that would be chosen by an unborn individual behind a veil of ignorance as to his preferences. A discussion of the effects of price discrimination on the welfare of minority and majority consumers concludes the chapter.

The topics studied in Chapter 2 are related to the work of Michael Spence (1976), who studies product selection in the presence of fixed costs when there are no search frictions. Some of the mechanisms at work in the model presented in this chapter are very similar to those underlying recent developments in the literature on wage inequality in labour markets. In particular, Daron Acemoglu (1996, 1998, 1999) and Stephen Machin and Alan Manning (1997) show that, as a consequence of imperfect information and matching frictions, an increase in the supply of a particular type of labor leads to a more-than-proportional increase in the number of firms using a technology designed for that particular type of labor. Similarly, in the model presented in Chapter 2 changes in the composition of the demand base cause more-than-proportional changes in the composition of supply.

Chapter 3 uses economic analysis to shed some light on the debate about the effects of globalization on cultural diversity. Many commentators, especially in Europe, argue that increasing economic integration has resulted in the cultural predominance of the United States. In particular, they claim that most national markets for cultural goods, such as films, TV shows, books, and music are awash with American products. Available data for the film industry seem to confirm these claims, as American films command 85% of the world market and 90% of the European market. The conclusion that some European commentators draw is that this state of things is *necessarily* bad for consumers outside the United States and that therefore other countries should be allowed to protect their culture and, with it, their cultural industries. This concerns, expressed especially by France, were allegedly the reason for the "Television without Frontiers" Directive, passed by the European Commission in 1989. This directive imposed very strict quotas on the showing of non-European films, that were also de facto subjected to a discriminatory tax treatment. In 1993 these discriminatory measures were challenged by the United States during the trade liberalization talks of the GATT, but were successfully defended by France, which invoked the principle of "Cultural Exception", according to which cultural industries should not be exposed to liberalization to the same extent as other sectors.

To analyze these issues, I develop a monopolistically competitive model of international trade in which cultural varieties are produced under increasing returns to scale and can be traded at some cost between two countries of asymmetric size. This standard framework is extended by assuming that consumers have a stronger preference for varieties that are typical of the culture of their own country than for varieties that are typical of the culture of the other country. In the equilibrium of this model an increase in economic integration considerably reduces the market share of the varieties typical of the culture of the small country. However, if integration is caused by a reduction in real transport costs, it nevertheless benefits the consumers of this country. The model also shows that a country that is not too small relative to the dominant country can increase its welfare by adopting a limited level of trade protection, whereas for a very small country free trade is optimal. This seems to suggest that some limited degree of cultural protection could make sense for a relatively large country like France, but would be detrimental for small countries such as the Scandinavian countries or the Netherlands, which have in fact been historically very open to the consumption of American and English cultural products.

Chapter 1

Per Capita Income and Industrial Demand in Economic Development and International Trade

1.1 Introduction

In this chapter I present a model in which the level of demand for goods that can only be produced using increasing returns to scale technologies plays a crucial role in determining the success or failure of industrialization in closed economies and the pattern and volume of international trade in an integrated world. In particular, I use this model to analyze the separate effects of average income, income distribution, and population size first on the equilibrium number of industrial sectors in an economy in which international trade is prohibitively costly and then on the pattern of specialization and the volume of trade in an integrated world in which economies can trade with each other. An important feature of the model in this chapter is that, contrary to previous contributions, it allows me to investigate the issues mentioned above while maintaining quite natural assumptions about technology, market structure, and price-setting by firms and provides therefore an interesting and relatively simple way of studying the importance of non-competitive pricing in the process of economic development.

Most of the growth in the economic well-being of large parts of the world over the last two centuries can certainly be attributed to the discovery and successive large-scale production at affordable prices of a great variety of new products and services, the production of which, almost without exception, requires substantial fixed R&D and production costs. This expansion of the menu of available products has also played an important role in fostering the growth of world trade. Many factors, such as fundamental breakthroughs in basic science and the establishment of appropriate institutional frameworks that protect intellectual property, have certainly had a crucial impact on these developments, but the latter could simply not have happened if there had been insufficient demand to cover the fixed costs of innovation and production. Indeed, the importance of the extent of the market for industrialization has become one of the deepest and most widely held convictions of the economic profession, starting with Adam Smith's work until our days. Research in this field has flourished since Avinash Dixit and Joseph Stiglitz (1977) and Michael Spence (1976) have provided tractable models of monopolistic competition within which to study the relationship between fixed costs, industrial variety, and non-competitive pricing. Subsequently, Paul Krugman (1979, 1980), Kenneth Judd (1985), and Paul Romer (1990) have shown the potential of these models in explaining the importance of market size for the dynamics of innovation and international trade.

Why, then, another model on the extent of the market, industrialization, and international trade? A short answer to this question is that, by treating demand aggregation in more detail than in previous contributions, the model in this chapter can help define the extent of the relevant market for industrial products more precisely and can therefore greatly improve the ability of existing theories to explain different development realities. In all the monopolistically competitive models of industrialization and international trade cited above, preferences pose no aggregation problem and market demand depends only on an economy's aggregate income, as measured by its GDP. In these models there is no difference between a country with low per capita income and large population and a country with high per capita income and small population, provided that they have roughly the same aggregate GDP. Analogously, in these models income distribution plays no role in determining the extent of the market for industrial products, provided that aggregate GDP is held roughly constant. In other words, once the effect of aggregate GDP on industrialization has been controlled for, these models do not provide any insight into the role played by the level and the distribution of per capita income in an economy. To see why this is an important shortcoming, consider the following example. Germany and India have roughly the same PPP-adjusted aggregate GDP, but Germany has a population that is more than ten times smaller than India's, and, consequently, a PPP-adjusted per capita income that is more than ten times higher than India's.[1] If taken literally, most general equilibrium monopolistically competitive models would conclude that, since these two countries have the same aggregate GDP and thus the same market size, one should expect them to have the same level of industrialization. However, virtually no businessman considering whether to supply some innovative and rather expensive non-tradable service, such as laser eye-surgery or high-speed train connections, would consider the Indian market to be nearly as profitable as the richer, though smaller, German market. Most Indians would not have the necessary resources to afford these services, and the relevant market for them would be much smaller in India than in Germany.

There is indeed systematic evidence that the level of per capita income and population size are important factors in explaining industrialization. Hollis Chenery, Sherman Robinson, and Moshe Syrquin (1986), in a detailed cross-section and time-series study of the industrialization experience of some selected countries, provide evidence that demand, as explained mainly by per capita income,

[1] In 1999 India had an aggregate PPP-adjusted Gross National Income of 2,226 billion dollars, a population of 998 million people, and a PPP-adjusted per capita income of 2,230 dollars. In the same year, Germany had a PPP-adjusted aggregate Gross National Income of 1,930 billion dollars (approximately 0.9 times that of India), a population of 82 million people (approximately 12 times smaller than that of India), and a PPP-adjusted per capita income of 23,510 dollars (approximately 10 times higher than that of India). All data are from the World Development Indicators 2001, The World Bank.

has played an important role in determining the decline of agriculture and the rise of industrial sectors in virtually all of the countries that they study.[2] A larger population allows countries to industrialize at lower levels of per capita income, but cannot completely compensate for the negative effects of low levels of per capita income on industrial demand.

Besides the level of average income, income distribution also plays an important role in determining the extent of demand for industrial products. Kevin Murphy, Andrei Shleifer, and Robert Vishny (1989) discuss several examples in which too much or too little concentration of wealth seem to have constituted an obstacle to industrial development. David Landes (1969) discusses how the level of per capita income, and especially its distribution among different classes, may have been crucial in determining sufficient demand during the early stages of the British industrial revolution.

The model that I present in this chapter provides the first theoretical analysis of the relationship between *average*, or per capita, income and industrialization and offers an alternative framework within which to study the effects of income distribution, effects that have also been considered in Murphy, Shleifer, and Vishny (1989) and Kiminori Matsuyama (2002). The next section will explain in some detail the differences between these two models and mine.

The model presented here can also be fruitfully used to explain a well-known stylized fact of International Economics. This is the observation that, contrary to the predictions of the standard Heckscher-Ohlin theory of international trade, over the last decades a large share of world trade has taken place between countries at similar stages of economic development and with rather similar factor endowments. The volume of trade among developed countries largely outweighs the volume of trade between the former group and developing countries. While

[2]However, it should be noted that, although domestic demand plays an important role in explaining industrialization, their findings show that other factors, and especially export demand and shifts in the supply side of the economy, play an equally, if not even more, important role.

the relatively low volume of North-South trade could be partly explained by many years of protectionist trade regimes in developing countries and by the small economic size of the developing world,[3] it may also be, at least in part, the consequence of very different demand structures between the two regions. In his now classic study of these issues, Staffan Linder (1961) presents evidence that the volume of trade between two countries is increasing in the similarity between their per capita income, even after controlling for their aggregate GDP. The explanation of this fact that he proposes, known as the Linder hypothesis, relies on the different demand structures of countries with low and high per capita income: poor countries tend to consume many less product varieties than rich countries do and this severely limits the scope for trade between the former and the latter, as the varieties that are demanded in rich countries tend, at least in the first phases of the product cycle, to be produced there and traded only with other rich countries. In other words, and returning to our previous example involving Germany and India, virtually no businessman who considers exporting the latest version of a DVD-player would consider these two markets to have an equivalent potential, as he knows that he will be able to export many more DVD-players to the, smaller but wealthier, European country than to India. The model that I present below clearly shows how similarity in per capita income, combined with economies of scale in production and trade costs, determines the pattern and the volume of bilateral trade.[4]

In order to address the issues outlined above, this chapter starts by analyzing an economy in which individuals consume divisible amounts of food, that is produced under constant returns to scale, and possibly many industrial goods, produced under increasing returns to scale. Since the marginal utility of food is

[3]James Markusen and Randall Wigle (1990) use a constant returns to scale, perfectly competitive, computable general equilibrium model of world trade to show that a liberalisation of world trade and an increase in the economic size of the developing world would considerably increase the volume of North-South and South-South relative to North-North trade.

[4]The next section will present a brief discussion of theoretical and empirical contributions that are closely related to the international trade implications of my model.

assumed to be decreasing and consumers are assumed to derive utility only from the first unit of each industrial goods, the level and distribution of per capita income matters for demand, as richer consumers are willing to spend more of their income on industrial goods than poorer consumers. For given prices, higher average income is therefore conducive to more industrialization. However, in a closed economy with given aggregate GDP, higher average income also means a smaller population size and thus a higher average cost of production, which has a negative effect on industrialization.[5] I analyze how these two effects combine to determine the equilibrium number of industrial sectors for different levels of per capita income. I also show that income inequality reduces the number of industrial sectors in an already rich economy but could help jump-start the process of industrialization in poor economies. Finally, I consider a world with two countries that can trade their goods at some cost, and show that the patterns of specialization and the predictions on the volume of trade implied by the Linder hypothesis arise naturally in this model.

The remainder of the chapter is in five sections. Section 1.2 discusses where the existing literature stands as regards the implications of per capita income and demand for economic development and international trade. Section 1.3 sets out the model of a closed economy and analyzes the implications of different levels of average income and income distributions for industrialization. Section 1.4 uses this model to study international trade between two countries with different per capita income levels and derives results that constitute a formal version of Linder's insights. Section 1.5 discusses the implications of my approach for the distribution of gains from trade between and within countries. Section 1.6 concludes.

[5]Note that throughout the chapter I will keep aggregate GDP (but not necessarily per capita income and population size) constant, since, as mentioned above, the positive effects of greater aggregate GDP for industrialization have been already established in the existing literature.

1.2 Related literature

1.2.1 Development Economics

The issues studied in this chapter are closely related to those considered by Murphy, Shleifer, and Vishny (1989, MSV hereafter) and by Matsuyama (2002). However, the approach taken here differs in some important respects from these two contributions.

MSV consider an economy in which consumers have a minimum food consumption requirement, after which the marginal utility of food drops discretely and consumers begin to derive utility from a variety of indivisible manufactured goods. Manufactured goods can be produced by a monopolist using an increasing returns to scale technology with high fixed and low marginal costs or by a competitive fringe using a constant returns to scale technology with high marginal cost. MSV consider the effects of income distribution on the equilibrium share of sectors that adopt increasing returns to scale technologies, rather than on the number of goods, and thus of manufacturing sectors, which they take as exogenously given. This is a consequence of the assumption that manufactured goods can also be produced under constant returns to scale. This assumption makes the optimal pricing problem very tractable in their model, since all active monopolists will charge a price equal to the constant marginal cost of the competitive fringe, but has some other important drawbacks. In reality many of the most important innovations in the process of economic development could simply not have been carried out by a competitive fringe without bearing substantial fixed costs; one needs only think of transportation systems, drugs, high-tech electronic systems, etc. If these goods and services are introduced at all, they usually can be produced by only few firms and non-competitive pricing becomes therefore crucially important. My model shows how monopolistically competitive firms unchallenged by a competitive fringe set their prices optimally according to the level and distribution of per capita income in the economy, and it does so without giving up tractability. Optimal price-setting has important implications for the number of industrial sectors that can profitably operate, as a smaller but richer customer base might be willing to pay more for innovations than a larger and poorer one. Since the monopolists in MSV do not adjust their prices when per capita income changes, they only care about the size of the customer base, and not about the elasticity of demand for industrial products, as determined by per capita income. Furthermore, MSV's assumption that the marginal utility of food is almost everywhere constant, except at the point where it drops discretely, implies that their model does not have much to say about the effects of *average* income on industrialization, once aggregate income has been controlled for. The setup of the present model allows me to address this issue in a rather detailed and tractable way.

Matsuyama (2002) also considers the effects of income distribution on industrialization, and particularly on the emergence of a mass consumption society, in which large parts of the population have access to a large variety of industrially produced goods. He uses a model in which perfectly competitive producers have access to a technology which is characterized by dynamic scale economies and in which endogenous productivity growth plays an important role. In Matsuyama's model, consumption of a given good by the upper class makes it chaper to produce in successive periods and therefore affordable to poorer classes. This "trickle-down" effect is accompanied by a "trickle-up" effect, whereby consumption of goods by the lower classes reduces the price of these goods for the upper classes, allowing them to devote some of their resources to the purchase of new goods. A virtuous circle of innovation becomes therefore possible in this economy. Matsuyama shows that if a society is too egalitarian this virtuous circle will never start, whereas if it is too inegalitarian it will easily stop. Although my model also addresses the effects of income distribution on industrialization, it does so in a static context and does not deal with technological change.

1.2.2 International Trade

When looking for theoretical explanations of the empirical relevance of North-North trade, economists usually turn to monopolistically competitive models of international trade,[6] as introduced in Paul Krugman (1979, 1980) and Elhanan Helpman (1981) and consolidated in Helpman and Krugman (1985). These models have developed a consistent general equilibrium framework to analyze how product differentiation and increasing returns to scale in production can give rise to trade even in the absence of comparative advantage. In particular, these models predict that the volume of trade should be large between countries with large and similar market size, as measured by aggregate GDP –see also Helpman (1987). In these models, once one controls for the effects of aggregate GDP, per capita income can have effects on the volume and composition of trade only if it is related in some way to factor endowments and therefore to the supply side of the economy. Helpman and Krugman (1985, Chapter 8) analyze this possibility by using a model that combines differences in factor endowments with economies of scale and imperfect competition, and by assuming that higher levels of per capita income correspond to greater capital abundance. They find that one should expect the *share* of intra-industry trade in total trade to be higher in trade flows between countries with similar per capita income levels. However, in their framework, once the level of GDP has been controlled for, the *total volume* of bilateral trade is still maximized between countries with different relative capital abundance, and thus with different levels of per capita income. To see this, consider the integrated world equilibrium box in Figure 1.1. This figure represents a world with two countries, two factors of production (K and L), and two sectors (X and Y). Each sector has many monopolistically competitive firms. The amounts of the two factors of production used by sectors X and Y are represented by the segments 0_1X and 0_1Y, respectively, and sector X

[6] However, see Davis (1997) for an alternative neoclassical model.

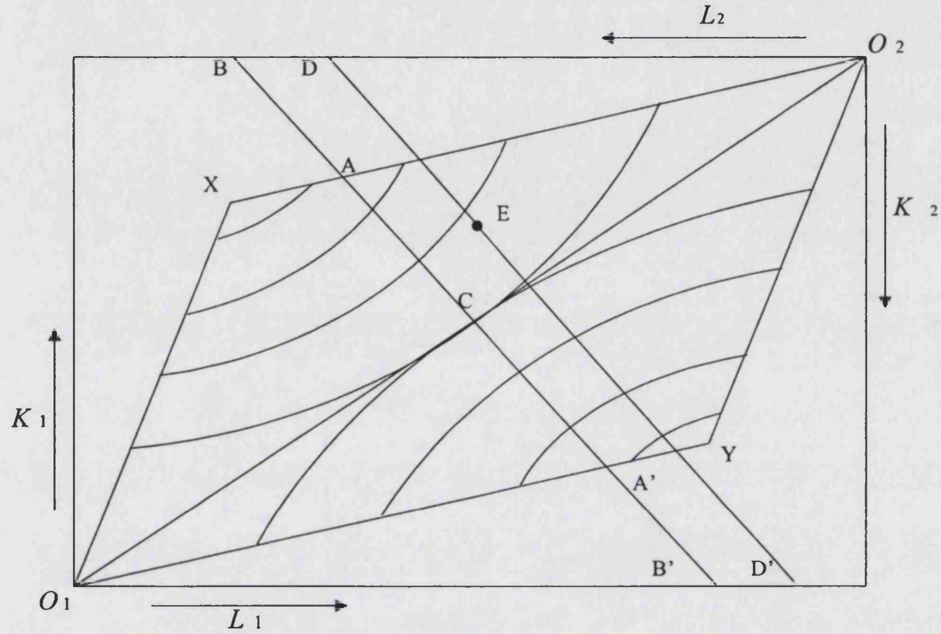

Figure 1.1: The integrated world equilibrium.

is therefore capital intensive. For all factor endowments inside the quadrangle 0_1X0_2Y, factor prices are equalized and both countries use the same capital-labor ratios in both sectors. Also, note that at all factor endowment points along a line such as DD' – e.g. point E – total GDP in each of the two countries is constant, and that the total GDPs of the two countries become more similar the nearer to the center, represented by point C, one moves. In a world as the one described in Figure 1.1, the volume of intra-industry trade is maximized when the factor endowments of the two countries lie on the BB' line, since on this line the two countries have identical GDPs. However, the *total volume* of trade, including both intra-industry and inter-industry trade, is maximized at A or A', since at this point the volume of Heckscher-Olin trade is maximized for given volume of intra-industry trade. Points A or A' imply rather different capital-labor ratios, and thus different per capita income levels, between the two countries, a prediction at odds with available evidence.[7]

The implications of per capita income for the composition of demand and thus for the volume of trade have been carefully considered from a theoretical point of view by James Markusen (1986) and Kiminori Matsuyama (2001) and shown to be empirically relevant in Linda Hunter and Markusen (1988) and Hunter (1991).[8] Markusen considers a case in which the income elasticity of the demand for capital intensive goods is greater than one and shows that as the relative factor endowments, and thus relative per capita incomes, of the North and the South become more dissimilar, the volume of North-North trade increases relative to the volume of North-South trade. Intuitively, this happens because every region tends to consume relatively more of the good in which it is becoming progressively more specialized. However, the assumption that the production of the high income elasticity good is relatively intensive in the factor that is in relatively abundant supply in the rich country is crucial: if it were reversed, so would be the results. Although Markusen's framework neatly captures some of the aspects of Linder's reasoning, the two differ markedly in one respect: whereas demand is crucial in determining which country develops new products in the Linder hypothesis, it has no implication for specialization in Markusen's model. In the latter it is relative factor endowments that determine *independently* both inter-industry specialization, through technology, and the composition of demand, through per capita income: only if the two effects happen to operate in the same direction Linder's conclusion regarding the volume of trade obtains. The model presented in this chapter generates instead Linder-

[7]In monopolistically competitive models with only one factor, as in Krugman (1979, 1980), the volume of trade is constant with respect to per capita income once total GDP has been controlled for.

[8]Hunter and Markusen (1988) estimate a linear expenditure system for 34 countries and 11 commodity groups and reject the hypothesis of homothetic preferences at very high levels of statistical significance. Hunter (1991), using the same methodology and data as in the previous paper, compares actual trade flows to those that would obtain in a counterfactual world with homothetic preferences, and shows that the volume of trade would increase by 29 percent if preferences were indeed homothetic.

type results without having to rely on any assumption on factor intensities.

Matsuyama (2000) also analyzes the implications of non-homothetic preferences for international trade. His model is however rather different from my model, as he assumes constant returns to scale and perfect competition in production and focuses mostly on the implications of differences in per capita income for the terms of trade rather than for the volume of trade.

1.3 The Closed Economy Model

Consider a stylized economy that is inhabited by a continuum of N individuals. Individual k is endowed with $y(k)$ effective units of the only factor of production, labor, so that the total labor supply in the economy is equal to $Y = \int_0^N y(k)\mathrm{d}k$ effective units. Higher individual endowments of effective units of labor can be interpreted as higher individual productivity levels, which I take as exogenously given. This set up will be used in the rest of the chapter to compare economies with equal levels of Y, and thus, given the assumptions that follow, with equal levels of aggregate GDP, but with different population sizes – and thus levels of per capita income – and different income distributions. This economy produces a good z (e.g., food), under perfect competition and using a constant returns to scale technology that requires one effective unit of labor per unit of output produced. This good is used as numéraire and its price normalized to one; this implies that the wage rate per effective unit of labor is also unity, since, as I shall show, some positive amount of z will always be produced in equilibrium. Individual k's income, expressed in units of the numéraire good, is therefore equal to her endowment of effective units of labor $y(k)$. Besides this constant returns to scale good, this economy also knows how to produce a continuum of varieties of a manufactured good, with each particular variety being denoted by the index $i \in [0, \infty)$. Each variety is produced under increasing returns to scale, with a fixed amount of F effective units of labor and a marginal labor requirement of c effective units. I assume that the manufacturing sector is characterised by free entry and exit of firms, and accordingly I model it as being monopolistically competitive. I also make the crucial assumption that, while the numéraire good z can be bought in any divisible amount, available manufactured varieties are indivisible and consumers derive utility only from the first unit of each variety that they consume. Namely, I assume that all consumers have identical preferences and choose $z \in [0, \infty)$ and $x(i) \in \{0, 1\}$, for all i, to maximize the following additively separable utility function

$$U = u(z) + \int_0^n x(i)\mathrm{d}i, \tag{1.1}$$

subject to

$$z + \int_0^n p(i)x(i)\mathrm{d}i = y(k); \tag{1.2}$$

where $p(i)$ is the price of variety i and n is the total number of varieties that the individual chooses to consume. Furthermore I assume that $u'(\cdot) > 0$, $u''(\cdot) < 0$, and $\lim_{z \to 0} u'(z) = \infty$. These assumptions imply that the marginal utility of income $u'(z)$ is decreasing in income and that some positive amount of z is always produced in equilibrium.

1.3.1 Equilibrium with perfect equality

In this section I analyze the equilibrium of a perfectly egalitarian closed economy where all consumers have income $y(k) = y$. The effects of income distribution on industrialization and product variety are discussed in the next section.

Assume that each consumer is simultaneously offered the numéraire good z and many industrial varieties at prices given by the function $p(i)$. Let manufactured varieties be indexed in such a way that $p(i)$ is non-decreasing in i. Since the consumer purchases a quantity of each variety which is equal to either zero or one, she effectively chooses only z and how many and which of the available manufactured varieties to consume. Since all varieties are equally indivisible and enter utility symmetrically, the consumer always chooses to purchase the n cheapest varieties. This means that $x(i) = 1$ for all $i \leq n$ and she chooses n by solving the following maximization problem

$$\max_n u\left(y - \int_0^n p(i)\mathrm{d}i\right) + n, \qquad \text{s.t. } n \geq 0. \tag{1.3}$$

The first order condition of this problem is given by

$$\frac{1}{u'\left(y - \int_0^n p(i)\mathrm{d}i\right)} \leq p(n), \tag{1.4}$$

with equality if $n > 0$ and strict inequality if $n = 0$. The interpretation of (1.4) is straightforward: consumers will expand their consumption of manufactured varieties up to the point where the marginal benefit from variety, given by the left hand side of (1.4), is equal to its marginal cost, given by the right hand side of (1.4), when both are measured in terms of the numéraire good z.

Next I turn to the production side of the economy, in which firms are free to enter and choose prices as to maximize their profits. I first determine the profit-maximizing price profile $p(i)$ for given number n of active firms; then I use the implications of free entry in the market to determine the number n of active firms.

The first important result is that, for any given number of firms $n > 0$, the unique profit-maximizing price profile is $p(i) = p^*$ for all $i \leq n$ such that

$$\frac{1}{u'\left(y - np^*\right)} = p^*. \tag{1.5}$$

This can be proved as follows. For any given profile of prices $p(i)$, $i < n$, firm n chooses an optimal price $p(n) = p^*$ such that $\left[u'\left(y - \int_0^n p(i)\mathrm{d}i\right)\right]^{-1} = p^*$, since the firm's profit would be increasing for any price that were strictly less than p^* and would drop to zero for any price that were strictly greater than p^*. Since $p(n) = p^*$ and $p(i)$ is non-decreasing by assumption, in order to prove that $p(i) = p^*$ for all $i \leq n$, I only need to prove that $p(i)$ cannot be strictly increasing on $[0, n]$. If $p(i)$ were strictly increasing over some range of this interval, firms with low indexes over this range, and thus with low prices, could increase their profits by slightly increasing their price, because consumers would drop higher indexed goods from their consumption bundle first, and thus the deviating firm could increase its price without losing any demand, which would obviously be a profitable deviation. This establishes that $p(i) = p^*$ for all $i \leq n$ is indeed the unique profit-maximizing equilibrium price profile for given n.

By looking at equation (1.5) one can see that, since $u''(\cdot) < 0$, the profit-maximizing price p^* charged by each active firm is increasing in the level of the economy's per capita income y, for any given n. Intuitively, consumers derive lower marginal utility from food in richer markets and are therefore willing to spend more on each manufactured variety. Therefore, if the market power of incumbent firms were not eroded by the entry of new firms, the former could charge higher prices for their goods in richer markets.[9]

However, in an equilibrium with free entry, the ability of firms to charge high prices for their goods is constrained by the threat of entry by possible competitors. In particular, free entry ensures that in equilibrium all active firms charge a price equal to average cost

$$p^* = c + \frac{F}{N} = c + fy. \tag{1.6}$$

where $f \equiv (F/Y)$ is the fixed cost of each variety normalized by effective labor supply and I have made use of the fact that $Y = Ny$. Note that, since Y is

[9]This possibly important effect, which emerges quite naturally in this model, is not present in other models of economic dvelopment that assume contestable markets and thus limit pricing by monopolistic firms.

kept constant in this model in order to control for the well-known effects of total market size on product variety, there must necessarily be an inverse relationship between per capita income y and population size N. Since in this model each consumer only purchases one unit of each variety, a smaller N implies a smaller scale of production and thus higher average costs. Therefore, given aggregate GDP, a closed economy with high per capita income and small population size has higher prices of manufactured varieties in a free-entry equilibrium than a closed economy with large population size and low per capita income.

Using (1.5) and (1.6), the equilibrium number of varieties n as a function of per capita income is given by

$$\frac{1}{u'(y - n(c + fy))} \leq (c + fy), \tag{1.7}$$

with equality if $n > 0$ and strict inequality if $n = 0$.
Equation (1.7) provides a complete characterization of the equilibrium relationship between the level of per capita income y of an economy with given aggregate GDP and the number n of industrial sectors in this economy. Note that existing general equilibrium models of monopolistic competition – e.g. Dixit and Stiglitz (1977), Krugman (1979, 1980), and Judd (1985) – cannot capture this relationship, as in them the number of industrial sectors is determined solely by the level of aggregate GDP, independently of the level of per capita income.

To understand how the equilibrium number of varieties n is affected by changes in y, it is instructive to consider Figure 1.2. The P^*P^* line represents the profit-maximizing price p^* as a function of per capita income y, *for given number of varieties* n, as given by (1.5).[10] An increase in n makes the P^*P^* curve rotate clockwise around the origin, as it implies a lower p^* for any given y in equation

[10]Given what has been assumed so far about $u(\cdot)$, it can be shown that the P^*P^* line must go through the origin and be increasing. However, as will be discussed further below, it does not need to be concave as shown in Figure 1.2, although this is probably the most interesting economic case.

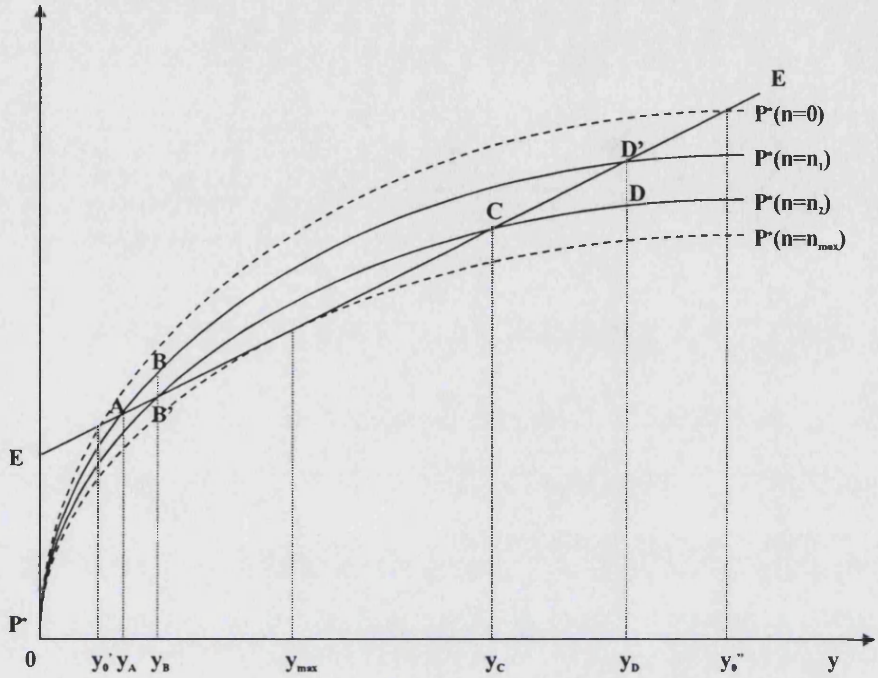

Figure 1.2: Equilibrium with a concave P^*P^* curve.

(1.5). Figure 1.2 displays four different P^*P^* lines, for $n = 0 < n_1 < n_2 < n_{max}$ in clockwise order.

The straight line EE represents instead the equilibrium average cost for any given level of per capita income y, as given by (1.6).

Given any level of income y, the number of varieties n adjusts so that the economy reaches an equilibrium at the intersection of the P^*P^* and EE curves. This setup can be used to perform a comparative statics exercise in order to analyze how n depends on y. Consider a level of per capita income y_A for which equilibrium is reached at point A with a number of varieties $n = n_1$. Assume now that per capita income increases from y_A to y_B. At this new level of y, if the number of firms n remained unchanged at n_1, the profit-maximizing price that firms could charge for their variety would be given by point B and would be higher than average cost, which is given by point B'. This opportunity for profits would trigger entry of new firms, which would make the P^*P^* curve rotate clockwise and the economy reach a new equilibrium at point B', with a number of varieties $n_2 > n_1$. In general, for any level of $y < y_{max}$, an increase in y causes an increase in p^*, i.e. in the willingess of consumers to pay for a manufactured variety, which is greater than the induced increase in the equilibrium average cost, and therefore causes an increase in equilibrium product variety. Note, however, that for very low levels of per capita income, i.e. for $y < y_0'$ there will be no industrialization, i.e. $n = 0$.

If instead the economy were to start at point C and per capita income increased from y_C to y_D, the willingness of consumers to pay for a manufactured variety would now be given by point D, which is lower than the average cost given by point D'. Therefore the number of firms n would decrease, making the P^*P^* curve rotate anti-clockwise and the economy would reach a new equilibrium at point D' with $n_1 < n_2$. If the P^*P^* curve has the shape depicted in Figure 1.2, for any level of $y > y_{max}$, an increase in y causes an increase in p^*, i.e. in the willingess of consumers to pay for a manufactured variety, which is less than the induced increase in the equilibrium average cost, and therefore causes a reduction in equilibrium product variety. If per capita income is extremely high, i.e. $y > y_0''$, and thus population size extremely small, there will be no industrialization, i.e. $n = 0$.

If the utility that consumers derive from food can be represented by then simple constant elasticity form $u(z) = z^\sigma/\sigma$, with $0 < \sigma < 1$, one obtains an example in which the economy can be depicted as in Figure 1.2. In this case the number of product varieties as a function of y has the following simple expression

$$n = \max\left\{\frac{y - (1+fy)^{\frac{1}{1-\sigma}}}{1+fy}, 0\right\}. \tag{1.8}$$

Figure 1.3 represents equilibrium product variety as a function of per capita income y, in the case in which the P^*P^* curve has the concave shape shown

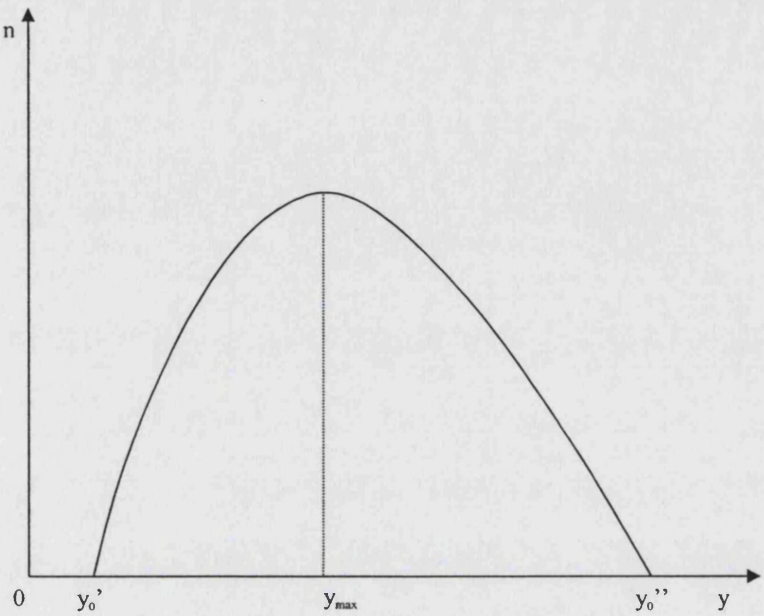

Figure 1.3: Number of varieties and per capita income.

in Figure 1.2. As one can see, for given total GDP, there is a non-monotonic relationship between per capita income and product variety. For low levels of y (and thus very large population size N), an increase in y, and thus a decrease in N, increase equilibrium product variety. This is because when average cost is initially low, a decrease in population size does not increase it substantially, whereas the ensuing increase in per capita income substantially increases the willingness of consumers to spend on manufactured varieties and the prices firms can charge for their products with it. The opposite result obtains when y is high (and thus population size N is low). This result suggests therefore that, if the extent of domestic demand matters because international trade is very costly and given reasonable assumptions on the marginal utility of income, after controlling for total GDP one should expect countries with either very small or very large population size to have a smaller number of industrial varieties than countries with intermediate population size.

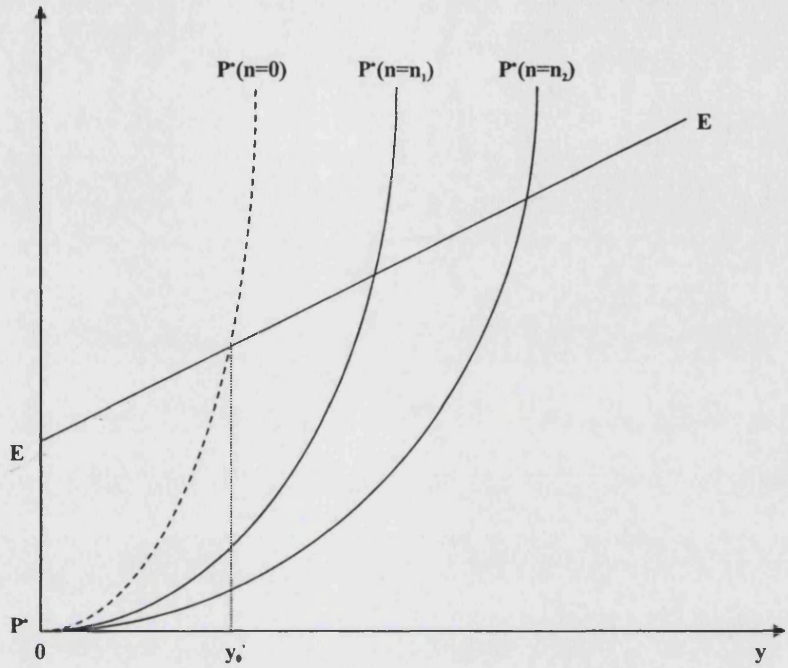

Figure 1.4: Equilibrium with a convex P^*P^* curve.

However, as mentioned before, the case illustrated in Figures 1.2 and therefore 1.3 is not the only theoretical possibility. The P^*P^* curve, as drawn in Figure 1.2, has the property that p^* does not grow too fast as y grows, which is the case when the marginal utility of income does not fall too fast when y grows. However, other situations, in which the marginal utility of income falls faster than average cost grows when y grows very large, are possible, although probably less interesting and realistic. Figure 1.4 represents one example in which p^* grows faster than average cost when $y \to \infty$. In this case equilibrium product variety is everywhere increasing in the level of per capita income. This theoretical possibility does not however seem to be the most realistic description of the world, as it would imply without exception that an economy populated by a single very rich person has the highest possible potential for industrialization. In the rest of the chapter, and especially in the next section in which I study the effects of income inequality on industrialization, I will therefore assume that

$u(\cdot)$ is such that the economy can be represented as in Figure 1.2.

1.3.2 Income inequality

The analysis in the previous section can be used to derive some intuitive results on the implications of income inequality for the level of industrialization and the number of products introduced in closed economies at different stages of economic development. The most interesting lesson to be learned from such an analysis is that whether inequality has a positive or negative effect on industrialization depends crucially on the level of *average* per capita income in the economy. Although a much more general analysis is possible, here I will illustrate this important point and the intuition behind it with a very simple, though very special, example.

Assume that consumers are divided into only two income classes: a certain share of the population is poor and, for the sake of simplicity, is assumed to have no income at all; whereas the remaining share of the population is rich and owns all of the economy's income. Furthermore, assume that income is equally distributed within the upper class. Provided that total income Y and total population size N are kept constant, so is average per capita income y. I now analyze what happens when the size (and therefore the per capita income) of the upper class changes. Notice that, since in this simple example the destitute class has no income, the only source of demand for industrial products is the upper class. Increasing income inequality, which is achieved by decreasing the size and increasing the individual income of the upper class, has two effects: on the one hand it increases the willingness of each member of the upper class to spend on industrial products at given prices, which has a positive effect on industrialization, and on the other hand it deacreases the size of the customer base for industrial products and thus it increases their average cost and price, which has a negative effect on industrialization. The relative strength of these two effects can be gauged by looking at Figure 1.3. Given the assumption that the destitute class owns no income and has thus no demand for industrial varieties, increasing income inequality, which corresponds here to decreasing the size of the upper class, is equivalent to making the relevant market for industrial varieties less populated and richer, an therefore to moving from left to right in Figure 1.3. If the economy has high *average* per capita income to start with (i.e., if $y > y_{max}$), then increasing income inequality decreases the equilibrium number of product varieties. This happens because decreasing the size of the upper class increases average cost by more than it increases the willingness of its members to spend on industrial product varieties, decreasing the number of products that can profitably be introduced in the market. In other words, for rich economies, once one controls for aggregate GDP, it is high average costs of production, not high marginal utility of income and thus food, to hinder industrialization. Therefore the level of industrialization in small and rich economies is maximized by perfect equality, which allows to expand the relevant market for industrial products as much as possible. On the contrary, if the economy is large and has low *average* per capita income (i.e., if $y < y_{max}$), increasing inequality, which corresponds here to decreasing the size of the upper class, has a positive effect on industrialization, as it is equivalent to moving from left to right in Figure 1.3. This is because this change induces an increase in the willlingess of each memeber of the upper class to spend on industrial varieties that is greater than the increase in average cost, making thus the introduction of more industrial varieties possible in equilibrium. In other words, for poor economies, once one controls for aggregate GDP, it is high marginal utility of income and thus food, not high average costs of production, that hinder industrialization. Therefore, a certain degree of inequality in poor economies can be necessary to create sufficient demand for industrial products and jump-start the process of economic development.

1.4 International Trade

I now use the basic framework developed in the previous section to study how the distribution of world income among different countries affects international specialization and the pattern and volume of international trade. I will limit my analysis to the case in which there is perfect equality within each country and differences in per-capita income only exist between countries.[11]

Assume that the world is populated by N individuals with an aggregate supply of effective units of labor equal to Y, and thus with *average* per capita income $y \equiv Y/N$, and is divided into two countries, the rich North and the poor South. Producers in both countries have access to the same technology and to the same unique productive factor, labor, as described in the previous section. However, the two countries have different endowements of effective units of labor and different population sizes. In particular the South has a share $\alpha \in [0,1]$ of the total world supply of the productive factor, i.e. $Y_S = \alpha Y$, and a share $\beta \in [0,1]$ of the world population, i.e. $N_S = \beta N$, and has therefore per capita income equal to $y_S = (\alpha/\beta)y$. Analogously, the North has $Y_N = (1-\alpha)Y$, $N_N = (1-\beta)N$, and thus $y_N = ((1-\alpha)/(1-\beta))y$. Since I assume that the North is richer in per capita income terms than the South, it must be the case that $\alpha < \beta$.[12] In this context, $\alpha/\beta \in [0,1]$ is a good measure of equality, with higher values indicating values of y_S/y_N that are closer to one.

Assume that the North and the South can trade in an integrated world market, and that, while the numéraire good z can be traded at no cost, international trade of manufactured varieties is costly. In particular, I assume that, in order to sell its product on a foreign market, a producer has to pay a fixed cost of T units of labor – and, for future conveniency, I define $\tau \equiv T/N$. This cost

[11]For an analysis of the effects of intra-regional inequality on the volume of trade with other regions, see Maurice Kugler (2001).

[12]Note that I am not imposing any restrictions on α and β separately, and am therefore making no assumptions about the total market size of the two countries.

T might represent the cost of setting up a distribution network or of obtaining certification of the good in the foreign country, and it is realistic to assume that it does not change considerably with the volume of exports. In order to simplify the analysis, I also assume that, except for this fixed market penetration cost, there are no shipping costs. Given the absence of shipping costs for both producers and consumers, arbitrage ensures that the *consumer* price of a given good is the same in both markets, implying that the trade cost T of exporting a given variety is borne entirely by the producer.[13]

1.4.1 International equilibrium

I now construct and analyze an equilibrium in which consumers in the North purchase the same varieties that are purchased by consumers in the South, and possibly some more; where the varieties purchased by both Northern and Southern consumers have a lower price than those that are purchased only by Northern consumers, since they are produced on a larger scale; and where the varieties purchased by both Northern and Southern consumers are the only varieties to be internationally traded.

In what follows I will assume that all consumers in the South consume the same varieties of the indivisible good.[14] This assumption guarantees that there

[13]Given the particular structure of the present model, the assumption that there exists a positive market penetration cost that is borne by producers is crucial in order to obtain interesting results. To understand why, note that in the present model, given that consumers purchase either zero or one unit of each variety, producers could shift the entire burden of the shipping cost onto the consumers – in other words, the present model is the limiting case of one in which the elasticity of demand tends to zero. Therefore, if shipping costs were the only trade costs, they would not affect at all the profits of producers and would therefore have no effect on their location decision, leading to an indeterminacy in the pattern and volume of international trade. This issue does not arise in other models of international trade or economic geography under monopolistic competition – see, e.g., Krugman (1979, 1980), and Masahisa Fujita, Paul Krugman, and Anthony Venables (1999) – because in those models consumption of each variety can, and does, adjust in response to changes in shipping costs, with the consequence that the burden of the trade cost is borne by both consumers and producers.

[14]This assumption is not very restrictive: if one thinks that in reality goods have different degrees of indivisibility, then all consumers in the South would consume the same n most divisible goods. This would hold even if the differences in the degree of indivisibility across

exists a unique equilibrium of this model. Finally, I focus on equilibria in which neither country is completely specialized in manufacturing, i.e. in which there is some production of the numéraire good z in both countries and therefore in which the wage rate in the two countries is equalized.[15] In what follows, I first describe the general structure of an equilibrium with international trade and analyze the location decision of producers; I then use the restrictions implied by the model to solve for the number of varieties that are traded and for the total volume of trade in equilibrium.

Note that, when a given variety is available on both markets, it must be sold at the same consumer price in every market, as the absence of any shipping cost for consumers allows for perfect arbitrage. Equation (1.4) implies that, when all consumers face the same prices, richer consumers purchase at least as many varieties as poor consumers do, and possibly some more.[16] Therefore, since $y_N > y_S$, if the same varieties purchased by Southern consumers were available in the North, they would certainly be purchased by Northern consumers. Denote by n the number of varieties purchased by Southern consumers and note that these varieties can be potentially exported to the North, since there is demand for them there. Since the consumer price at which each of these varieties sells is the same in both countries, producers of these n varieties locate in the country which allows them to minimize trade costs, i.e. in the larger country: if $\beta > 1/2$ they locate in the South and if $\beta < 1/2$ they locate in the North. If trade costs are not prohibitively high, these n varieties will be exported form the country

goods are infinitesimally small, a case which is approximated by my model.

[15]This is the case if either $\beta < 1/2$ or $\beta > 1/2$ and $u'\left(\left(\alpha/\beta - 1/2\right)y\right)\left(c + fy + \tau\right) > 1$. The details of the derivation of this condition are tedious and omitted here, but are available from the author on request. Here it is sufficient to note that, if this condition is not satisfied, the South completely specializes in manufacturing and thus wage equalization could break down. However, this is never the case if the marginal utility of food, which could be scaled up arbitrarily, and/or the average cost of manufactured varieties are sufficiently high, so that the share of the manufacturing sector in total expenditure is relatively small.

[16]Laurence Jackson (1984) finds strong evidence that such an Engel curve for variety is indeed very important in microeconomic consumption data.

where they are produced to the other country. This is the case if the total profit on exports, $\min\{\beta, 1-\beta\}N(p_n - c)$, are sufficiently high to cover the fixed trade cost, T, i.e. if $\min\{\beta, 1-\beta\}(p_n - c) \geq \tau$. To determine the threshold level of the trade cost τ below which exporting is profitable, note that in a free-entry equilibrium the price charged by an exporting firm must be equal to its average cost, or

$$p_n = c + fy + \tau. \tag{1.9}$$

Therefore a firm located in a given market exports to the other market if and only if

$$\tau < \tilde{\tau} \equiv fy \cdot \frac{\min\{\beta, 1-\beta\}}{\max\{\beta, 1-\beta\}}, \tag{1.10}$$

whereas there will be no trade if $\tau > \tilde{\tau}$.

Note that if (1.10) holds and the n varieties purchased by everybody in the world are traded, equation (1.4) implies that northern consumers might have some demand for an additional number m of varieties besides the cheaper n varieties (depending on how high the price of these additional varieties is). However, since there is no demand for these varieties in the South, they would be produced in the North and would not be exported, becoming endogenously non-traded goods.[17] Therefore, if $\tau < \tilde{\tau}$, all international trade takes place in those n varieties for which there is demand in both countries, whereas if $\tau > \tilde{\tau}$ international trade breaks down. This suggests that, when two countries are very unequal in per capita income terms, there is very limited potential for trade between them, as the poor country demands very few industrial varieties, a result that is proved formally in the rest of this section.

As in the previous section, assume that varieties are indexed so that $p(i)$ is non-decreasing in i. For a logic analogous to that in the previous section, utility

[17]These varieties are *endogenously* non-traded goods, in the sense that they are not traded in equilibrium even though the exogenously assumed level of trade costs τ for these varieties is identical to that of other varieties that are indeed traded in equilibrium.

maximization by Southern consumers implies the following first order condition

$$\left[u'\left(y_S - \int_0^n p(i)\mathrm{d}i\right)\right]^{-1} \leq p(n), \tag{1.11}$$

with equality if $n > 0$ and with strict inequality if $n = 0$.

Given that $y_N > y_S$, Northern consumers purchase at least the n varieties purchased by Southern consumers, and maximize their utility by choosing a number m of additional varieties so that

$$\left[u'\left(y_N - \int_0^{n+m} p(i)\mathrm{d}i\right)\right]^{-1} \leq p(n+m), \tag{1.12}$$

with equality if $m > 0$ and with strict inequality if $m = 0$.

In an equilibrium in which firms maximize profits it must be the case that $p(i) = p_n^*$ for all $i \leq n$ and $p(i) = p_m^*$ for all $\{i : n < i \leq n+m\}$, such that

$$p_n^* = \left[u'\left(y_S - np_n^*\right)\right]^{-1}, \tag{1.13}$$

$$p_m^* = \left[u'\left(y_N - np_n^* - mp_m^*\right)\right]^{-1}. \tag{1.14}$$

Furthermore, in an equilibrium with $n > 0$, each of the n active firms selling to both Northern and Southern consumers must make zero profits, which is the case if (1.9) holds. Analogously, in an equilibrium in which $m > 0$ each of the m active firms selling only to Northern consumers must make zero profits, which is the case if

$$p_m^* = c + \frac{fy}{1-\beta}. \tag{1.15}$$

Using (1.9) and (1.15) in (1.13) and (1.14) one obtains

$$\left[u'\left(\frac{\alpha}{\beta}y - n\left(c + fy + \tau\right)\right)\right]^{-1} \leq c + fy + \tau, \tag{1.16}$$

$$\left[u'\left(\frac{1-\alpha}{1-\beta}y - n\left(c + fy + \tau\right) - m\left(c + fy/\beta\right)\right)\right]^{-1} \leq c + fy/\beta, \tag{1.17}$$

where (1.16) holds with equality if $n > 0$ and with strict inequality otherwise, and (1.17) holds with equality if $m > 0$ and with strict inequality otherwise.

The equilibrium described by equations (1.16) and (1.17) has a simple interpretation. The number n of varieties that are consumed everywhere in the world is determined by the level of per capita income in the poor country, as shown in equation (1.16). These varieties are produced in the country with the largest population and, for $\tau \leq \tilde{\tau}$, are exported to the other country. In any case, these are the only varieties that are traded between the two countries. For given world *average* per capita income y and for given distribution of population between the two countries, β, the per capita income of the poor country and thus the number n of varieties that are traded is increasing in α, the degree of equality between per capita income in the North and in the South. This increase in the number of traded varieties causes an increase in the total volume of trade between the two countries, as will be discussed formally in the next section. Besides the n varieties consumed by everybody in the world, there might be a number m of other varieties that are purchased only by consumers in the North, as shown in equation (1.17); the equilibrium price p_m of these varieties is higher than the equilibrium price p_n of the n traded varieties, as confirmed by comparing (1.9) and (1.15) for $\tau \leq \tilde{\tau}$, since the smaller scale at which their production takes place entails a higher average cost, and this higher price makes them in turn affordable only to Northern consumers.

1.4.2 The volume of trade

I now compute the volume of bilateral trade, expressed as the sum of the exports of the two countries. Note that if $\beta < 1/2$, i.e. if the North is more populous than the South, the South imports the n varieties from the North in exchange for exports of good z. If instead $\beta > 1/2$, the North imports the n varieties from the South in exchange for exports of good z.

Balanced trade implies that the value of exports of the North is equal to the value of exports of the South, when expressed in a common numéraire. This allows us to write the volume of trade as twice the value in terms of good z of the least populous country's imports of manufactured varieties. Since each consumer in this country purchases one unit of each of these n varieties, and there are $\min\{\beta, 1-\beta\}$ such consumers, the volume of trade, measured in terms of units of good z, is

$$VT = 2(c + fy + \tau) \cdot N \cdot \min\{\beta, 1-\beta\} \cdot n(\alpha)$$

if $\tau \leq \tilde{\tau}$ and zero otherwise. The notation $n(\alpha)$ reminds the reader that n is an (increasing) function of α, which is a measure of equality between North and South.

The total volume of trade can expressed as a share of total world GDP, Y, as follows

$$vt = \frac{VT}{Y} = \frac{2(c + fy + \tau)}{y} \cdot \min\{\beta, 1-\beta\} \cdot n(\alpha). \tag{1.18}$$

Since n is an increasing function of α, it is straightforward to conclude that, for a given world distribution of population β, the volume of trade between the North and the South is unambiguously increasing in α, i.e. in the similarity between the two countries' per capita income.

This result is a simple formal restatement of the Linder hypothesis: when two countries have more similar per capita income levels, they have more similar demand patterns and a larger number of the goods produced in each of them is actually traded, implying that the volume of trade between them increases. Note that in the present model model an increase in the physical volume of trade is caused by two distinct effects, that are captured by the terms $\min\{\beta, 1-\beta\}$ and $n(\alpha)$ in (1.18). The former effect is standard in the literature on international trade under monopolistic competition and increasing returns: a higher $\min\{\beta, 1-\beta\}$ means that consumers are distributed more evenly between the two countries and therefore that a larger number of units *in each given product variety* actually crosses the border. The latter effect is what really captures the essence of the argument in the present chapter : countries with more similar per capita income tend to have more similar consumption bundles and a larger number n of varieties is actually traded between them.[18]

1.5 Notes on Gains from Trade and Welfare

In this model, as in most models of product variety under increasing returns and free entry, both countries gain from trade. These gains accrue through scale effects in the production of the n traded varieties: when trade costs fall and markets become more integrated, each of these varieties can be produced at lower average cost and is thus sold at lower equilibrium prices, allowing consumers in both countries to afford and enjoy larger variety. However, countries with different per capita income levels do not gain from trade to the same extent in the present model: the country with lower per capita income gains relatively more than the other.[19] This is due to the fact that, whereas scale effects make the price of all the varieties consumed in the South decrease, as all of these

[18]Note that the former effect, together with the assumption of costant world GDP, already captures all the known results on the volume of trade in the existing literature on international trade under increasing returns and monopolistic competition. To understand why this is an important observation, one should note that when α is increased, not only the per capita income of the two countries becomes more similar, but also the degree of similarity of their aggregate income changes. Since it is known that the degree of similarity between two countries' aggregate GDPs has an effect on the volume of their bilateral trade in existing models (see, e.g., Krugman, 1979 and 1980), it may seem that one could not distinguish between the effects on n of changes in Y and in y in the present model. However, this is not the case. In existing models, for given world GDP, the total number of varieties is given independently of how this aggregate world GDP is distributed between the two countries. In these models, the *only* effect of making the GDPs of two countries more similar is that more units *in any given product variety* will actually cross the border. In the present model this effect is entirely captured by the term $\min\{\beta, 1-\beta\}$. Therefore, for given β, a change in α affects the volume of trade *only* through the effect that this has on per capita income, which in turn affects the number of varieties that are traded.

[19]This finding complements the well-known result according to which the country with smaller market size gains relatively more from trade, through a more dramatic increase in variety over what could be afforded in autarky.

varieties are traded, the price of those varieties that are consumed only in the North, and that are therefore not traded, is not affected by a reduction in trade costs.

Furthermore, the present model also suggests that, when an inegalitarian economy opens to trade, different classes of consumers gain differently depending on the level of development of the trade partner. Assume that the North is populated by some rich and some poor consumers, and that the poor consumers in the North have the same level of per capita income as the consumers in the egalitarian South. Focusing attention on changes in consumers' welfare in the North, poor consumers gain relatively more than rich consumers, since the latter will not enjoy a reduction in the price of some of the goods that they consume, while all the goods consumed by the former become cheaper. Even though the very special structure of the model that gives rise to this result suggests particular caution in interpreting it, this is an interesting way of reconsidering the distributional consequences of North-South trade. Since poor consumers in the North are usually associated with unskilled workers, Stolper-Samuelson effects make them particularly vulnerable to trade with the South. Notwithstanding the unresolved debate about the different causes for the increasing wage gap in developed countries, few would deny that such an effect could, at least in principle, be relevant. However, the model in this chapter suggests that, due to different demand behavior, the poor in the North are also those benefiting more *as consumers* from trade with the South, since the price index associated with their consumption bundle falls by more than that associated with the consumption bundle of the rich. Turning to inequality in the South and by a symmetric argument, one can see that the rich in the South gains relatively more than the poor in the South from trade with the rich North.

1.6 Conclusion

Economists and economic historians have long recognised that, besides the size of the market, also the level and the distribution of per capita income have important implications for the introduction of new industrial products, the pattern of international specialization and the volume of trade flows. These implications cannot, however, be adequately captured by the existing literature on product variety under increasing returns and monopolistic competition. In this chapter I tackled the issue using a simple model, that embeds the assumption of indivisible manufactured goods in an otherwise rather standard monopolistically competitive framework. The more realistic treatment of the demand side of the economy that follows from this assumption allowed me to derive what I think are intuitive and relevant results. Given a number of closed economies with similar total market size, as captured by aggregate GDP, I show that economies with intermediate population size and per capita income levels have a larger number of products than both very small and rich and very large and poor countries. I also show that income inequality has a positive effect on the level of industrialization in poor economies, whereas the level of industrialization in rich economies is maximized by perfect equality. These results hint at a possibly profitable application of the present model to growth theory: by clearly distinguishing between the effects of per capita income and of the number of people in the economy, my approach can help shed some light on the much debated importance of population size and scale effects for the process of economic development.[20]

The model has also strong implications for explaining the pattern of international specialization and the volume of North-South trade, and offers a theoretical framework within which to analyze the Linder hypothesis. When two countries with different levels of per capita income can trade their goods

[20] Charles Jones (1999) reviews current research on this topic.

in integrated world markets at some cost, some goods may be consumed and produced only in the North and may become endogenously non-traded. As the similarity in the countries' per capita incomes increases, so do the number of product varieties that are actually traded and the bilateral volume of trade.

As concerns welfare considerations, the approach taken here suggests that countries at different levels of development gain from trade to a different extent, with poorer countries gaining relatively more than richer ones. Further, trade-induced changes in the welfare of poor and rich consumers within an inegalitarian country also depend on the level of development of the trading partner: all else equal, consumers with personal income levels more similar to those prevailing in the trading partner are those who gain relatively more from trade.

Chapter 2

Product Selection and Mass Consumption in Markets with Costly Search

2.1 Introduction

This chapter proposes an explanation for the degree of diversity in consumption and production observed in markets in which trade is characterized by search frictions and technology by economies of scale. In particular I analyze the mechanisms that can induce consumers with heterogeneous preferences for different varieties of a good or service to exhibit homogeneous consumption behaviour, a situation that I call mass consumption. It is worth emphasizing from the outset that the explanation proposed in this chapter does *not* rely on the existence of network effects, whereby the utility from consuming a given variety increases in the number of other individuals consuming the same variety.[1] Instead I construct a model in which mass consumption can emerge in equilibrium solely as a consequence of the existence of search frictions in the market and specialization in production, even if the utility functions of consumers are completely independent. The basic idea behind the theory is intuitive. By making consumers less selective in their choice of the varieties that they are willing to purchase, search frictions reduce the sensitivity of firms' profits to competition and thus

[1] I will discuss these and other related models in a separate section devoted to a review of the existing relevant literature.

their incentives to produce niche varieties. In turn, the limited availablity of their preferred varieties in equilibrium justifies the choice of some consumers not to be selective. This idea has profound implications for product selection, the relationship between the size of a group of consumers and the welfare of its members, and the optimality of policies aimed at promoting production of varieties preferred by minorities. This analysis also sheds some light on the economic effects of the growing diffusion of the Internet and of other advances in telecommunication technology, by predicting the implications of a fall in search costs for the composition of production and the distribution of consumer welfare.

To address these issues I construct a stylized model with a certain degree of heterogeneity in goods and preferences, economies of scale in production, and a trading system characterized by random matching and costly search, as briefly described below. I consider the steady-state of a market in which two types of consumers, who constitute different proportions of the population and have *idiosyncratic* preferences for two possible varieties of a good, are randomly matched with producers. The non-convexity of the production technology is simply captured by assuming that producers, who pay a fixed cost to be in business, have to specialize in *either* variety before being matched with consumers and can thereafter produce at constant marginal cost. I first analyze a case in which, upon meeting a consumer, producers can perfectly recognize her vaulation for their good, i.e. a case of perfect first-degree price discrimination. This rules out possible inefficiencies in pricing and therefore allows us to study the consequences on product selection of a single well-defined informational problem, namely costly search by consumers. The implications of imperfect price discrimination are addressed later in the chapter.

In selecting products, firms trade off two opposing effects on their profits: a customer base effect and a competition effect. Whereas, all else equal, the former effect induces firms to select very popular varieties, the latter effect makes specializing in niche varieties more profitable, since doing so allows producers to face less competition and charge higher prices. For very severe search frictions the customer base effect dominates the competition effect, with the consequence that all producers specialize in the most popular variety and the market is characterized by mass consumption. As search frictions fall, the profits of firms become more sensitive to competition and a larger number of them specializes in the niche variety. The share of the most popular variety in the total value of production is always larger than in a Walrasian market, where exchange is coordinated by a fictional auctioneer.

An interesting property of the model is that, although the matching function is characterized by constant returns[2], there are strong *scale effects* in the composition of demand, in the sense that an increase in the size of a group of consumers causes a more-than-proportional increase in the production of the variety preferred by that group. This over-response of supply to changes in the composition of demand is the reason for the existence of *consumption externalities*: an increase in the size of a group of consumers makes every member of the group better off in equilibrium, as it implies a higher probability of finding their preferred variety at a lower price. Finally, since a fall in search costs causes the share of the mainstream variety in total production to decrease, it benefits consumers with minority preferences relatively more than consumers with mainstream preferences.

Having determined the effects of search frictions on the equilibrium, I can use this model to compare the market outcome with the constrained optimal allocation of production. Such an allocation would be chosen by a social planner with the objective of maximizing the expected steady-state utility of a consumer who is behind a veil of ignorance as to what her type will be and who holds a diversified portfolio of shares in the profits of producers. I show that, for sufficiently

[2]In our setting this means that the matching speed depends only on the ratio of the number of producers to the number of consumers, and not on any of these numbers separately.

severe search frictions, mass consumption, which is the unique market equilibrium, is constrained optimal. However, when search frictions are sufficiently low, the market under-provides the variety preferred by minorities compared to the constrained optimal composition of production. This market failure is due to the fact that the matching process is characterized by decreasing expected marginal utility in the probability of finding one's preferred variety. This consideration makes an extremely unbalanced composition of production socially sub-optimal, but is not adequately taken into account by producers. Therefore the model suggests that policies aimed at encouraging production for small groups of consumers, e.g. medicines for rare diseases or certain types of unusual cultural consumption, might be justified in markets where search fricitions are not too severe.

After discussing the effects of costly search, I address a second informational problem that might have important effects on product selection, aggregate welfare and its distribution between majority and minority consumers: the imperfect ability of producers to distinguish between heterogeneous consumers. Analyzing imperfect price discrimination is important here from a methodological point of view, since it allows us to evaluate the robustness of our conclusions to different assumptions about pricing, and is also of interest in itself, given the great attention that this issue is receiving in current debates about electronic commerce.

Recently Amazon.com, a market leader in on-line retail of books, music and videos, has allegedly engaged in "dynamic pricing", a form of first-degree price discrimination made possible by the technology used in many forms of electronic commerce.[3] Dynamic pricing arises when on-line retailers can recognize the computer that is logging on to their system and use the history of previous visits to estimate the valuation of consumers for different varieties; they can then

[3]See Paul Krugman, *"What Price Fairness?"*, The New York Times, 4 October 2000.

quote a price conditional on the identity of the consumer. In a recent article that discusses the possible economic effects of this practice, Paul Krugman appears to suggest that such price discrimination might not only be socially efficient, but also work in favor of people with unusual preferences, by making their preferred varieties more easily available on the market. However, such a conclusion is not always warranted when there are indivisibilities in the production technology, as I show by means of a simple static version of our random matching model where producers endogenously choose the specification of their product. In this model an increase in the ability of producers to price discriminate may cause a shift in the composition of production towards the tastes of the majority. In particular, this is likely when the sizes of the two groups of consumers are not too different. In such a case, when firms are unable to price discriminate they choose a "middling" specification of their product, that appeals equally to both consumer types, and charge a unique price. However, when price discrimination becomes a profitable option, they maximize profits by choosing the product specification preferred by the majority, that they sell at different prices to all consumer types in the market. This shift in product selection, together with the fact that matching is random, implies that an increase in the ability of sellers to price discriminate can redistribute surplus away from consumers with minority preferences and towards consumers with mainstream preferences.

The rest of the chapter is organized in six sections. Section 2.2 briefly discusses how my work relates to the existing relevant literature. Section 2.3 describes the structure of the model, defines the search equilibrium and discusses the Walrasian allocation of this economy. In section 2.4, I solve a simplified version of the model where there is no substitutability in consumption between varieties as a means of introducing the basic mechanisms. Section 2.5 discusses the general case with substitutability between varieties and shows how mass consumption can emerge in equilibrium. Section 2.6 addresses the issue of imperfect price discrimination. Section 2.7 concludes.

2.2 Related literature

The issue of product selection in market economies has a long tradition in economics. In his account of the cultural and social consequences of modern mass production in the United States, Tibor Scitovsky (1976) expressed concerns that the presence of strong economies of scale in production and marketing would induce producers to choose products that appeal to the tastes of large groups of consumers and thus to discriminate against consumers with unusual tastes, unless the latter are sufficiently rich to afford to pay a very high price for their preferred variety. Though convincing, Scitovski's analysis does not propose a benchmark against which to evaluate how well the market fares in providing variety, given the fact that the production technology of many goods *is* characterised by increasing returns to scale. The task of constructing such a benchmark and of systematically studying the direction of the biases in product selection is undertaken in a classic article by Michael Spence (1976). Spence shows that a monopolistically competitive market tends to under-provide the products preferred by small groups of consumers with low elasticity of demand compared to the optimum.[4] One aspect of the problem that is not discussed by either Scitovsky or Spence is the fact that markets for differentiated goods are characterized by non-negligible search costs that consumers and producers have to bear to locate one another. In this chapter I illustrate that this fact has a number of important implications for actual and optimal product selection and for the relative welfare of majority consumers and minority consumers.

Many of the results obtained in this chapter also arise in models where trade is frictionless but there is a technical or social network component to consump-

[4] He also shows that allowing producers to price discriminate can eliminate this inefficiency, a result that will become relevant for the analysis in section 2.6 of this chapter, in which I discuss the effects of price discrimination on product selection.

tion activities (see, e.g., Michael Katz and Carl Shapiro (1985), Joseph Farrell and Garth Saloner (1985), Edi Karni and David Schmeidler (1990), and Gary Becker (1991)). However, the mechanisms behind the results of my model and those of the models mentioned above are very different, making them suited for the analysis of different types of goods and industries. In models with network externalities, the reason that a given variety or brand captures a very large share of the market is that utility functions display complementarity in consumers' decisions: the utility from a certain consumption choice increases as more consumers make the same choice. In my model consumers' utility functions are completely independent and the magnification effect, with the ensuing consumption externalities, arises endogenously as a consequence of the trading mechanism. Models with network externalities are particularly suited to analyse the consumption of goods such as VCRs, computer software and hardware, and to some extent other forms of social consumption like restaurant services, films and fashionable clothes. In contrast, my model seems to be more appropriate for other kinds of consumption in which the technical or social interdependence of people's choices is less evident but search costs are important, such as medicines, books or other differentiated and specialised goods or services.

Mass, or herd, behavior in the choice among different alternatives can also emerge because of informational cascades, as in Abhijit Banerjee (1992) and Sushil Bikhchandani *et al.* (1992). In those models, that assume identical preferences, agents may decide to overlook their noisy private signal about the payoffs of different alternatives and join the herd with the conviction that widely held behaviours reveal information about the best alternative. This mechanism does not operate in this chapter, since in my model consumers have perfect information about their preferences and the types of the good in the market, but do not know where to locate them.

Although the practical issues addressed are different, the mechanism operating in this chapter closely resembles that underlying recent developments in the literature on wage inequality in labour markets with costly search.[5] In particular, Daron Acemoglu (1996, 1998, 1999) and Stephen Machin and Alan Manning (1997) show that, as a consequence of imperfect information and matching frictions, an increase in the supply of a particular type of labor leads to a more-than-proportional increase in the number of firms using a technology designed for that particular type of labor. Similarly, in the model presented in this chapter changes in the composition of the demand base cause more-than-proportional changes in the composition of supply.

Recent work by Robert Shimer and Lones Smith (2000a, 2000b) also studies markets with costly search and heterogeneous agents. However, their work is concerned with cases of vertical heterogeneity, where everybody agrees on who makes a better match than others, whereas this chapter deals with a case of horizontal differentiation, where agents have idiosyncratic preferences over different alternatives.

Finally, this chapter is obviously related to the literature on search in product markets.[6]

2.3 Structure of the model

Consider a market for a differentiated durable good that comes in two possible varieties, denoted by $j = 1, 2$. Time is continuous and trade takes place between two distinct groups of risk neutral agents, consumers and producers, who discount the future at the common rate $r > 0$.

[5]See Christopher Pissarides (2000) for a comprehensive treatment of the search approach to the study of labor economics.

[6]See Joseph Stiglitz (1989) for a survey and further references.

2.3.1 Consumers and preferences

At any moment in time there is a unit measure of consumers, a share $\alpha > 1/2$ of whom is of type 1 (the majority consumers) with the rest being of type 2 (the minority consumers). Independently of her type a consumer only needs one unit of the good. If she is of type i and buys one unit of variety j at a price p_{ij}, she derives flow utility $u_{ij} - p_{ij}$, where $u_{ii} = 1$ and $u_{ij} = u < 1$ for $i \neq j$, $i, j = 1, 2$. Upon purchasing one unit of the good the consumer leaves the market and another consumer of the same type is born, so that both the total number of consumers and the shares of the two types in the market remain constant over time.[7]

2.3.2 Producers and technology

On the other side of the market, there is a large number of potential producers who can purchase one of an exogenously given number M of sites at a price γ and open their shop.[8] The market for production sites is perfectly competitive and the price γ of a site is therefore given by the net present value of an active firm. After having purchased their site, but *before* being matched with customers, producers can produce one, and only one, unit of *either* variety of the good at zero marginal cost. This assumption of complete specialization is meant to capture the importance of scale economies in many of the markets in which I am interested. I denote by ϕ the share of active producers that decide to specialize in variety 1, and by Φ the share of variety 1 in the total value of market production. After producers have decided in which variety to specialize, trade takes place according to the decentralized mechanism described in the next section. When a producer of type j eventually sells its good, it can also sell its production site

[7]This "cloning assumption" is very convenient in simplifying the algebra but does not affect the qualitative results of the model.

[8]The conveniency of this modelling choice, introduced by Daron Acemoglu (1999), will become apparent below when I compare the Walrasian equilibrium to the search equilibrium.

to a new producer and leave the market receiving an amount equal to $p_j + \gamma$.[9]

2.3.3 Random matching and the determination of prices

At any moment in time each consumer is matched with at most one *randomly drawn* producer with probability given by a Poisson process with arrival rate $a = a(M)$.[10] When a consumer and a producer meet, they immediately recognize each other's type (i.e., the consumer recognizes the variety carried by the producer and the producer recognizes the buyer's type) and they have to decide whether to trade or not. I discuss the reasons for assuming here that producers have perfect information as regards the types of the consumers with which they are matched – which amounts to perfect first-degree price discrimination – at the beginning of section 2.6, which analyzes the implications of relaxing this assumption. Let V_i denote the steady-state lifetime expected utility of an unmatched consumer of type i and R_j denote the steady-state value of a producer who has already purchased a site and specialized in variety j.[11] The equilibrium probability that a consumer of type i and a producer with good j conclude an exchange, conditional on the fact that they met, is denoted by x_{ij}. If they decide to trade, I assume that they do so at a price determined by the (possibly

[9]The results of the model would be unchanged if producers were infinitely lived and could therefore produce more than one unit of the good. However, here I assume that producers leave the market after selling one unit of their product to maintain a certain degree of symmetry between producer and consumers.

[10]Note that this implies constant returns to scale of the matching function, since the rate at which matches take place depends only on the ratio of the number of the two types of agents searching. Given the cloning assumption made above, that implies that the numbers of producers and consumers actively searching are not determined by the model, this property of the matching function is immaterial for the rest of our analysis, and it would not have important effects on our main results even without the cloning assumption. However, I want to emphasise here the property of constant returns of the matching function, because I will show below that the model displays strong scale effects in the composition of demand, that do not depend on increasing returns at the aggregate level. Furthermore notice also that, since in any equilibrium with positive matching frictions all M sites are used, each producer is matched with a consumer at the rate a/M.

[11]Note that in equilibrium the steady state value of an active producer will be equal to the price of a site, i.e. $R_j = \gamma$, and therefore the net expected value of a producer considering entry in the market is equal to zero.

asymmetric) Nash bargaining solution, with the producer receiving a share λ of the surplus that the match creates over and above the sum of the expected continuation utilities of the two parties. If they do not trade, they continue searching for another partner.[12]

2.3.4 Equilibrium with costly search

Given the structure outlined above, an equilibrium in this market can be defined as follows:

A steady-state search equilibrium is a tuple $\left\langle \phi^*, x_{ij}, p^*_{ij}, \gamma^* \right\rangle_{i,j=1,2}$ that satisfies:

1. Optimal product choice by firms: $R_1(\phi^*) = R_2(\phi^*)$ if $\phi^* \in (0,1)$, $R_1 \geq R_2$ if $\phi^* = 1$, and $R_2 \geq R_1$ if $\phi^* = 0$.

2. Probabilities of agreement x_{ij} consistent with Nash-bargaining for all i and j: $x_{ij} = 1$ if $u_{ij} > V_i(\phi^*) + R_j(\phi^*) - \gamma^*$, $x_{ij} = 0$ if $u_{ij} < V_i(\phi^*) + R_j(\phi^*) - \gamma^*$, and $x_{ij} \in [0,1]$ if $u_{ij} = V_i(\phi^*) + R_j(\phi^*) - \gamma^*$.

3. Free entry: $R_j(\phi^*) = \gamma^*$ if firm j is active.

2.3.5 The Walrasian allocation

Before proceeding to analyze the equilibrium with search frictions, it is instructive to briefly discuss what the Walrasian allocation of this economy would be if trade were frictionless. The Walrasian allocation consitutes a natural benchmark against which to evaluate the effects of search frictions on the equilibrium composition of production throughout the rest of the chapter.[13] In the Wal-

[12]See Martin Osborne and Ariel Rubinstein (1990) for a detailed analysis of the bargaining approach to the determination of prices in decentralized markets.

[13]Notice that I do not intend to attach any normative meaning to this comparison. Comparing the search equilibrium to the Walrasian equilibrium gives a positive prediction on the effects of search frictions on the composition of production. For normative purposes, one should consider constrained efficiency, which involves comparisons of environments characterized by the same level of search frictons. I study constrained efficiency in sections 2.4.2 and 2.5.2 below.

rasian equilibrium the price of both varieties equals (zero) marginal cost, and since profits are zero so is the price of sites γ.[14] Upon being born, every consumer of any type immediately finds and purchases her most preferred variety, obtaining utility equal to one. Finally, the share of variety 1 in the value of total production, Φ^W, is equal to the share of type 1 consumers in the population, α, since every consumer buys one unit of her most preferred variety. I will show below that, once trade is characterised by costly search, the market outcome systematically departs from the Walrasian allocation and, in particular, always displays $\Phi^* > \alpha = \Phi^W$.

2.4 The simple case with no substitutability

In this section I solve and analyze the model in the simple case in which consumers do not attach any value to their least preferred variety, i.e. in which $u = 0$. One should notice from the outset that this assumption does not allow me to discuss mass consumption in a strict sense, since under no conditions a consumer will ever decide to purchase her least preferred variety instead of continuing to search for her most preferred variety. Nevertheless, this simple version of the model has the merit of clearly introducing the basic mechanisms that bias the equilibrium of markets with costly search in favor of the varieties preferred by large groups of consumers, and also allows ume to carry out in a rather simple way some interesting, though preliminary, welfare analysis.

2.4.1 Equilibrium with search frictions

Notice that assuming $u = 0$ implies that in equilibrium consumers always reject their least preferred variety and always accept their most preferred variety as soon as they find it. Although in equilibrium consumers always purchase their preferred variety, the price that they pay for it crucially depends on their reser-

[14]Notice that $\gamma = 0$ implies constant returns to scale in the producers' production function, which in turn implies that there exists a Walrasian equilibrium of this market.

vation utility in the bargaining with producers, i.e. on their expected utility if they decide to remain unmatched. This steady-state level of expected utility depends on the probability that type i finds her preferred variety, $a\phi$ for type 1 and $a(1-\phi)$ for type 2, on the cost of waiting r, and on the surplus $(1-p_{ii})$ that she obtains when this happens. Formally, V_i must satisfy the following Bellman equations

$$
\begin{aligned}
rV_1 &= a\phi(1-p_1-V_1), \\
rV_2 &= a(1-\phi)(1-p_2-V_2),
\end{aligned}
$$

where I have used the fact that in equilibrium $x_{ii}=1$ and $x_{ij}=0$, for $i \neq j$, and simplified notation by writing $p_{ii}=p_i$. The interpretation of these equations is standard. One can think of V_i as the asset value of search for an unmatched consumer of type i: she can decide to either retain the option to search and obtain an instantaneous utility flow of rV_i, or, if given the opportunity to do so, which happens with probability $a\phi$ for type 1 and $a(1-\phi)$ for type 2, relinquish it and obtain a capital gain of $(1-p_i-V_i)$. Given the optimal stationary decision rule $x_{ii}=1$ and $x_{ij}=0$, the reservation utility for consumer i is that value of V_i that leaves her indifferent between these two alternatives. Rearranging and defining $m \equiv a/r$, one obtains

$$
\begin{aligned}
V_1(\phi) &= \frac{m\phi}{m\phi+1}(1-p_1), \\
V_2(\phi) &= \frac{m(1-\phi)}{m(1-\phi)+1}(1-p_2).
\end{aligned} \tag{2.1}
$$

Throughout the chapter I will use m as a measure of the speed of matching in the economy.[15] The assumption about the sharing of surplus between consumers

[15]Notice that I can do this because the expected lifetime utility V_i is homogeneous of degree zero in a and r, a very natural property since equal proportional changes in these two parameters only involve a rescaling of time.

and producers implies

$$p_i(\phi) = \lambda \left[1 - V_i(\phi) - R_i(\phi) + \gamma\right], \qquad i = 1, 2. \tag{2.2}$$

Substituting (2.1) into (2.2), and taking into account that free entry implies $R_i(\phi) = \gamma$, one obtains prices as functions of the share of producers specializing in the two varieties

$$\begin{aligned} p_1(\phi) &= \frac{\lambda}{m(1-\lambda)\phi + 1}, \\ p_2(\phi) &= \frac{\lambda}{m(1-\lambda)(1-\phi) + 1}. \end{aligned} \tag{2.3}$$

The price p_j is decreasing in the share of producers specializing in variety j, because an increase in the latter raises the reservation utility of a type j consumer and therefore lowers the price that she is willing to pay for her preferred variety.

The steady-state value R_j of a producer that has already purchased a site and specialized in variety j is given by

$$\begin{aligned} rR_1 &= (a/M)\alpha(p_1 + \gamma - R_1), \\ rR_2 &= (a/M)(1-\alpha)(p_2 + \gamma - R_2), \end{aligned}$$

which, taking into account the free entry condition $R_j = \gamma$ and substituting (2.3) for p_1 and p_2, can be written as

$$\begin{aligned} R_1(\phi) &= \frac{m\lambda}{M} \frac{\alpha}{m(1-\lambda)\phi + 1}, \\ R_2(\phi) &= \frac{m\lambda}{M} \frac{1-\alpha}{m(1-\lambda)(1-\phi) + 1}. \end{aligned} \tag{2.4}$$

By using part 1 (optimal product choice) of the definition of equilibrium, which implies that $R_1(\phi^*) = R_2(\phi^*)$ if both varieties are produced and $R_1 \geq R_2$ if only variety 1 is produced, one can find a unique closed form expression for the share of producers specializing in variety 1

$$\phi^* = \min\left\{\alpha + \frac{2\alpha - 1}{m(1-\lambda)}, 1\right\}. \tag{2.5}$$

The solid line in Figure 2.1 depicts ϕ^* for all m. When $m \leq \bar{m} \equiv \frac{1}{1-\lambda}\left(\frac{\alpha}{1-\alpha} - 1\right)$ the equilibrium has $\phi^* = 1$ and minority preferences go completely uncatered for. For $m > \bar{m}$ there is positive production of variety 2 in the market, and the share of firms specializing in this variety increases as matching improves.

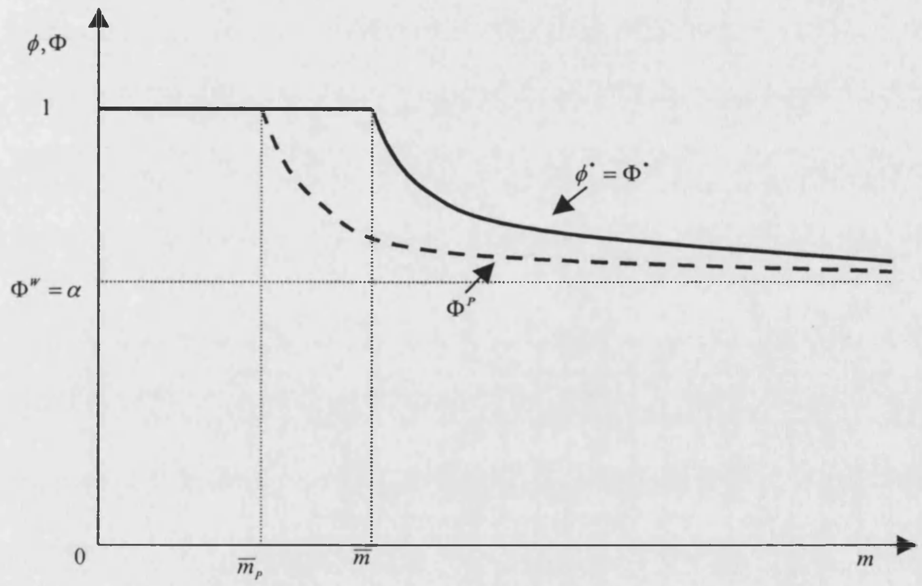

Figure 2.1: Share of type 1 producers for $u = 0$.

The intuition behind this result has to do with the interplay between a *customer base effect* and a *competition effect.* The customer base effect is obvious: for given ϕ, and thus given prices, an increase in the number of consumers of type i makes specializing in variety i more profitable, as it increases the expected volume of sales. Note that the strength of this effect does not depend on the level of matching frictions in the economy.[16] The competition effect operates

[16]This is because of the cloning assumption. If this were removed and a more general specification were adopted where the two types of consumers are born at the exogenously given rates α and $(1-\alpha)$ at every moment in time, and die at an exogenously given rate, then the steady state number of the two types of customers would depend on the different rates at

through prices, and crucially depends on m and ϕ. For given m, an increase in ϕ lowers the price of variety 1 and raises that of variety 2, as can be seen from (2.3), which makes specializing in variety 2 more profitable. Notice that, in an equilibrium with $\phi^* < 1$, it must be the case that $p_1(\phi^*)/p_2(\phi^*) = \alpha/(1-\alpha)$. Since $p_1(\alpha)/p_2(\alpha) > \alpha/(1-\alpha)$ and, as discussed above, the price of variety 1 relative to that of variety 2 is decreasing in ϕ, in equilibrium it must be $\phi^* > \alpha$.

The interplay between these two effects also explains the comparative statics of the model with respect to changes in m. Competition is extremely weak for very imperfect matching (note that if $m \to 0$ in (2.3) prices do not depend on ϕ at all). This is why for $m < \bar{m}$ the customer base effect dominates and all producers in the market specialize in the majority variety. When m grows larger, so does the sensitivity of producers' profits to competition and a larger number of them finds it convenient to switch to the niche variety, i.e. variety 2. Notice also that, for all m, ϕ^* is increasing in the bargaining power of the producer, λ. As $\lambda \to 1$ one has that $\phi^* = 1$ for all m. This is not surprising, since for $\lambda \to 1$ the model converges to one where the producer cannot commit ex-ante to leave any surplus to the consumer and the Diamond (1971) result applies: every producer is in a monopolistic position and the competition effect does not operate. Therefore allowing the producer to make a take-it-or-leave-it offer to the consumer would only work in the direction of making mass consumption more likely in equilibrium.

Given ϕ^*, one can derive the share of variety 1 in the value of total production, evaluated at market prices, and compare it to that of the Walrasian environment. The fact that $x_{ii} = 1$ and $x_{ij} = 0$ for $i \neq j$ implies that

which they leave the market, that in turns depend on the level of matching frictions in the market. However, the solution to this more complex model, which I do not include here but which I can make available on request, shows that the results of the present simplified model hold also in that more general case.

$$\Phi^* = \frac{\alpha p_1^* \phi^*}{\alpha p_1^* \phi^* + (1-\alpha) p_2^* (1-\phi^*)} = \phi^* \tag{2.6}$$

where the last equality follows from the fact that in any equilibrium with $\phi^* < 1$, and thus with equal profits from specializing in either variety, the relative price of the two goods must be $p_1^*/p_2^* = (1-\alpha)/\alpha$. Note that, for all m, $\Phi^* > \alpha = \Phi^W$. This shows that *in a market with costly search the market share of the varieties preferred by large groups of consumers is always larger than in the Walrasian allocation.* This result depends crucially on the existence of search frictions in the economy, as is demonstrated by the fact that the equilibrium share of variety 1 in the value of production converges to the Walrasian one when these frictions vanish, as can be seen by letting $m \to \infty$ in (2.5).

Although the assumed matching process is characterized by constant returns to scale, the equilibrium of the market studied in this model exhibits strong scale effects in the composition of the demand base, since an increase in the size of a given group of consumers causes a *more-than-proportional* increase in the production of the variety preferred by the members of that group. This can be seen by using (2.5) and (2.6) to derive the elasticity of Φ^* with respect to α

$$\eta = 1 + \frac{1}{m(1-\lambda)\phi^*} > 1 \tag{2.7}$$

Once again, it is easy to check that the existence of scale effects depends crucially on search being costly, as $\eta \to 1$ when $m \to \infty$. This result bears a striking resemblance to what in the international trade literature is known as "home market effect" (Krugman, 1980): in the presence of economies of scale in production and trade frictions between countries, an increase in the demand for some variety causes a more-than-proportional increase in the production of that variety, a mechanism that leads to the variety being exported by the country that produces it. However, whereas in the international trade literature the source of trade frictions is a physical transport cost for exchanges taking place under perfect information, here it is the presence of imperfect information and a less than perfect matching process between consumers and producers.

Finally, the welfare of each group of consumers in equilibrium can be analyzed by using (2.1) and (2.2) to obtain

$$\begin{aligned} V_1^* &= \frac{m(1-\lambda)\phi^*}{m(1-\lambda)\phi^*+1}, \\ V_2^* &= \frac{m(1-\lambda)(1-\phi^*)}{m(1-\lambda)(1-\phi^*)+1}. \end{aligned} \tag{2.8}$$

Since $\phi^* > 1/2$, i have $V_1^* > V_2^*$ for all $m < \infty$: consumers belonging to the majority group are better off than consumers belonging to the minority group because they are more likely to find their preferred variety and because, when they do, they have to pay a lower price for it. Note that, for given m, (2.5) and (2.8) imply that V_1^* is increasing and V_2^* decreasing in α: this model gives rise to *consumption externalities*, in that an increase in the size of a group of consumers makes its members better off and the members of the other group worse off. This is not the case in the Walrasian allocation, where consumers' welfare is independent of the relative size of the group to which they belong.[17]

Magnification effects and consumption externalities as those just described above arise also in models where there is a technical or social network component to consumption activities (see, e.g., Katz and Shapiro (1985), Farrell and Saloner (1985) and Becker (1991)). However, as discussed in section 2.2, the mechanisms that cause these effects and externalities in the present model are very different from those at work in those models and resemble more closely those at work in Acemoglu (1996,1998,1999) and Machin and Manning (1997).

[17]If one were to specify a general equilibrium model of production, where production of the two varieties uses two inelastically supplied factors with different intensities, then in a Walrasian market a consumer would actually be made *worse off* by an increase in the size of her group, because this would have the consequence of raising the equilibrium relative price of her most preferred variety. This relative cost effect would still operate also in our market with search frictions, but if η is large enough, which happens for low m or high λ, a consumer still benefits from an expansion in the size of her group.

Finally, improvements in the matching technology benefit consumers in a minority relatively more than consumers in a majority, as V_2^*/V_1^* is increasing in m for $m > \bar{m}$, and $V_2^*/V_1^* \to 1$ as $m \to \infty$. This means that the recent growth of the Internet might benefit consumers with minority preferences more than the large majority of consumers with mainstream preferences. The early diffusion pattern of the Internet may offer some indirect support for this thesis: the first private users of the Internet were people with very unusual interests who were willing to pay what at the time was a non-negligible cost to reduce their search costs. This seems to suggest that they derived a relatively larger benefit than people with mainstream interests from a reduction in search costs.

2.4.2 Welfare

The previous section has shown that, *when consumers know their type*, they would have contrasting interests if they were allowed to choose ϕ, since any change that makes one group better off necessairly damages the other. The question that I ask in this section is: what is the composition of production that would be chosen by a consumer who is behind a 'veil of ignorance' as to whether she will be of type 1 or of type 2 and who holds a diversified portfolio of shares in the profits of producers? In other words, I am interested in the informationally constrained optimal composition of production that maximizes the expected steady-state welfare of a representative unborn generation. I focus on a situation in which a social planner that can choose ϕ is subject to the same informational problems as the other agents in the market. In particular, this means that after the planner has chosen the optimal ϕ^P, consumers and producers are still matched in a completely random way.[18] Since Nash bargaining implies that all mutually profitable exchanges are effected and no inefficiency arises after a given

[18]The optimal composition of production ϕ^Pcan, for example, be implemented by devising an adequate system of subsidies to production without interfering with the exchange between producers and consumers.

match has occured, the planner does not have to take any further action after having chosen the optimal ϕ^P. Therefore the planner chooses ϕ^P as to solve

$$\max_{\phi\in[0,1]} W(\phi) = \alpha V_1 + (1-\alpha)V_2 + M\left[\phi R_1 + (1-\phi)R_2\right], \tag{2.9}$$

where V_i and R_j are functions of ϕ as given by (2.8) and (2.4), respectively. If one defines $g \equiv \alpha/(1-\alpha)$, the solution to this problem is

$$\phi^P = \min\left\{\frac{1}{1+\sqrt{g}}\left(\sqrt{g} + \frac{\sqrt{g}-1}{m(1-\lambda)}\right), 1\right\} \tag{2.10}$$

The share of variety 1 in the total value of production, evaluated at market prices, that is implied by the planner's optimal specialisation choice[19]

$$\Phi^P = \frac{gp_1^P\phi^P}{gp_1^P\phi^P + p_2^P(1-\phi^P)} = \frac{\sqrt{g}\phi^P}{\sqrt{g}\phi^P + (1-\phi^P)} \tag{2.11}$$

where the second equality follows from the fact that for ϕ^P as given by (2.11) the relative price of the two varieties is $p_2^P/p_1^P = \sqrt{g}$.

By comparing (2.5) to (2.10) one sees that $\phi^* = \phi^P = 1$ (and $\Phi^* = \Phi^P = 1$) for $m \leq \bar{m}_P \equiv \frac{\sqrt{g}-1}{1-\lambda}$, and $\phi^* > \phi^P$ (and $\Phi^* > \Phi^P > \alpha$) for $m > \bar{m}_P$. The comparison between the equilibrium and the optimal composition of production is illustrated in Figure 2.1 where the solid line depicts Φ^* and the dashed line depicts Φ^P.

It can be seen that, for $m \leq \bar{m}_P$, the market outcome, $\Phi^* = 1$, is optimal: search costs are too high relative to the number of type 2 consumers for positive production of variety 2 to employ the M sites efficiently.[20]

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[19]Note that prices are still well defined, as the planner does not interfere with the exchange process but only chooses production subsidies or taxes to influence ϕ.

[20]Notice that if the social planner were only concerned with maximizing the rate of production he would choose $\phi = 1$. This can be seen from the fact that the number of total matches at any moment in time is $\alpha\phi + (1-\alpha)(1-\phi)$, which is clearly maximised at $\phi = 1$ since $\alpha > 1/2$.

However, for $m > \bar{m}_P$, the market tends to systematically under-provide variety 2 compared to the optimal composition of production. This inefficiency arises from the fact that V_1 is concave in $m\phi$ and V_2 is concave in $m(1-\phi)$, as revealed by inspection of (2.8). In other words, the search process specified in this model is characterized by decreasing marginal utility in the the probability of finding one's preferred variety.[21] This implies that, given the probabilities α and $(1-\alpha)$ of being born as type 1 or 2, respectively, an individual behind a veil of ignorance would prefer to face a not very extreme composition of the market production. The market equilibrium fails to deliver the optimal composition of production because producers do not take into account consumer surplus when selecting products. To see this, notice that if $\lambda \to 1$, then $\Phi^P \to \Phi^* \to 1$: the social planner and market outcome coincide, as both maximize the value of sites (i.e. the aggregate level of profits in the economy), and consumers are indifferent as to the composition of production, since they never obtain any surplus.

2.5 Substitutability and mass consumption

Although the previous section unveiled some of the basic mechanisms that operate in the model introduced in section 2.3, assuming $u = 0$ makes it impossible to study the conditions that determine the emergence of mass consumption patterns where consumers with different preferences all end up consuming the same variety. In this section I solve and analyze the general version of the model with $u > 0$ and discuss under what conditions mass consumption is the equilibrium outcome in a market with trade frictions. I then compare the market equilibrium with the constrained optimal composition of production chosen by a social

[21]This property is complementary to that, first noticed by Stigler (1961), that, *for given sample composition*, there is decreasing marginal utility to the number of searches made by a consumer. Notice that the fact that in my model there is decreasing marginal utility to the composition of the urn in one's favour does not depend crucially on my assuming sequential search: similar results would obtain if consumers were sampling simultaneously a share $k < 1$ of the M producers and purchase with equal probability from all those that guarantee them equal surplus.

planner.

2.5.1 Equilibrium with search frictions

When $u > 0$, consumers are faced with a non-trivial economic choice every time they happen to be matched with a producer carrying their least preferred variety: they may decide to buy it and leave the market or not to buy it, remain in the market and continue searching until they find their most preferred variety. The outcome of this decision depends on the speed of search, m, and on the equilibrium probability with which a consumer finds either variety, ϕ for variety 1 and $(1-\phi)$ for variety 2. In deciding which product to specialize in, producers anticipate the acceptance rules adopted by consumers, and since the latter depend on the severity of search frictions, so does the equilibrium composition of production. I show below that, in the presence of costly search, variety 1 always has a larger market share than in the Walrasian equilibrium. In light of the results obtained in section 2.4, this is not surprising, as mass consumption becomes only more likely when varieties are to some extent substitutable in consumers' utility functions.

If consumers adopt optimal steady-state acceptance rules x_{ij}'s, as defined in part 2 of the definition of equilibrium, their expected lifetime utilities, V_i, corresponding to the asset value of search, must satisfy

$$\begin{aligned} rV_1 &= a\phi x_{11}(1-p_{11}-V_1)+a(1-\phi)x_{12}(u-p_{12}-V_1), \\ rV_2 &= a\phi x_{21}(u-p_{21}-V_2)+a(1-\phi)x_{22}(1-p_{22}-V_2). \end{aligned} \tag{2.12}$$

Given $x_{ij}(\phi)$ and $V_i(\phi)$, the surplus of any match is shared between the parties so that

$$p_{ij}(\phi) = \lambda\left[u_{ij} - V_i(\phi)\right], \quad \text{for } i,j = 1,2; \tag{2.13}$$

where I have already made use of the fact that in a free entry equilibrium $R_j = \gamma$

– see equation (2.2). Note that the premium that a consumer is willing to pay to obtain her most preferred variety over the price that she is willing to pay for her least preferred variety, $p_{ii} - p_{ij} = \lambda(1-u)$, is independent of m, a result that greatly simplifies the rest of our analysis.

Taking as given the x_{ij}'s and p_{ij}'s determined by (2.12), (2.13) and part 2 of the definition of equilibrium, active producers optimally select the variety in which to specialize as illustrated in part 1 of the definition of equilibrium. The steady-state value $R_j(\phi)$ of a producer specializing in variety j is

$$\begin{aligned} R_1(\phi) &= \frac{m}{M}\left[\alpha\, x_{11}(\phi)\, p_{11}(\phi) + (1-\alpha)\, x_{21}(\phi)\, p_{21}(\phi)\right], \\ R_2(\phi) &= \frac{m}{M}\left[\alpha\, x_{12}(\phi)\, p_{12}(\phi) + (1-\alpha)\, x_{22}(\phi)\, p_{22}(\phi)\right]; \end{aligned} \tag{2.14}$$

where I have already made use of the fact that in a free entry equilibrium $R_j = \gamma$. To simplify notation in what follows, I define $\bar{m}_1 < \bar{m}_2$ as

$$\bar{m}_1 \equiv \frac{1}{1-\lambda}\left[\frac{g}{1-u} - 1\right] \quad \text{and} \quad \bar{m}_2 \equiv \frac{1}{1-\lambda}\left[\frac{g+u}{1-u} - 1\right].$$

The following proposition characterizes completely the set of equilibria.

Proposition 1 *For any given m, α, and u there exists a unique equilibrium. In any equilibrium $x_{11} = 1$, $x_{12} = 0$, and*

(i) if $0 \leq m \leq \bar{m}_1$, then $x_{21} = 1$ and $\phi^* = 1$.

(ii) if $\bar{m}_1 < m \leq \bar{m}_2$, then $x_{21} = 1$, $x_{22} = 1$, and $\phi^* = \frac{\bar{m}_1}{m} < 1$;

(iii) if $m \geq \bar{m}_2$, then $x_{21} = 0$, $x_{22} = 1$, and $\phi^* = \alpha + \frac{2\alpha - 1}{m(1-\lambda)} < 1$.

Proof. In the Appendix.

The results of Proposition 1 are illustrated in Figure 2.2, that depicts the equilibrium share of producers specializing in variety 1 for all levels of matching

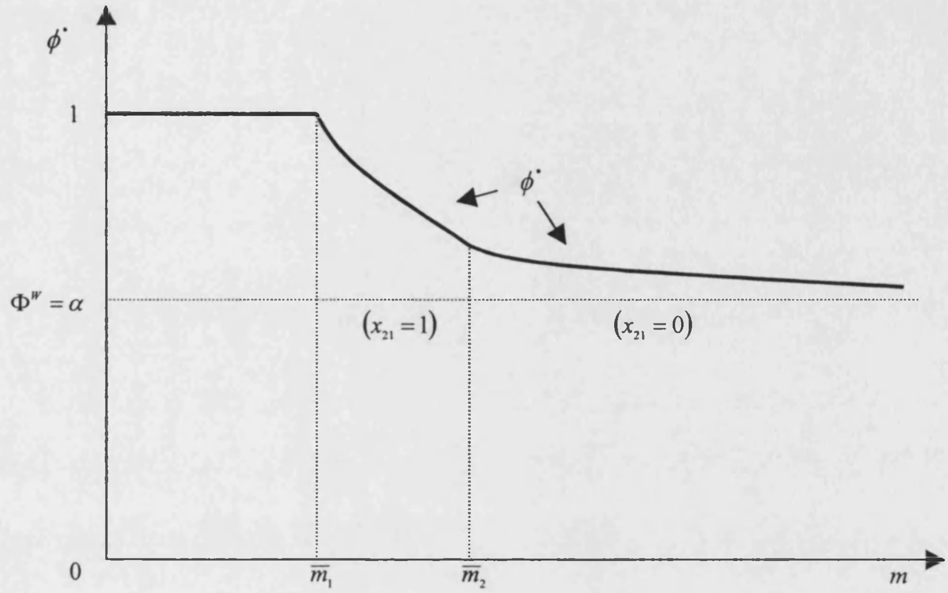

Figure 2.2: Share of type 1 producers for $u > 0$.

speed m. It can be seen that for very high search costs, i.e. for $m \leq \bar{m}_1$, mass consumption is the only possible equilibrium outcome: only variety 1 is introduced in the market and it is purchased also by type 2 consumers. The intuition behind this result is that, when matching is extremely costly, consumers cannot afford to be very selective and a producer is likely to sell to anybody showing up at his door; anticipating this, producers tend to choose the variety for which they are more likely to charge a high price, i.e. variety 1. Since type 2 consumers know that their preferred variety is extremely unlikely to be found in the market, they are willing to accept and pay a rather high price for variety 1. On the contrary, given the wide availability of their preferred variety, type 1 consumers would accept variety 2 only at such a low price that its production is not attractive to any potential producer. When search costs fall and one reaches the interval $\bar{m}_1 \leq m \leq \bar{m}_2$, the market goes through a transition phase in which some producers begin to specialize in variety 2 and sell only to the minority consumers, who still accept the mainstream variety 1 when they find it (i.e. $x_{21} = 1$ for $\bar{m}_1 \leq m \leq \bar{m}_2$). Finally, when $m \geq \bar{m}_2$ no consumer ever accepts her least preferred variety and the analysis of section 2.4 applies.

The equilibrium share of variety 1 in the total value of production is given by

$$\Phi^* = \frac{(gp_{11}^* + x_{21}p_{21}^*)\phi^*}{(gp_{11}^* + x_{21}p_{21}^*)\phi^* + p_{22}^*(1-\phi^*)}, \tag{2.15}$$

where I have made use of the result that in any equilibrium $x_{11} = 1$, $x_{12} = 0$, and $x_{22} = 1$ whenever $(1-\phi) > 0$. It is easy to prove that, for all m, $\Phi^* > \alpha = \Phi^W$ and that $\eta > 1$, which implies that both the scale effects and consumption externalities discussed in the previous section are still present.

2.5.2 Welfare

When $u > 0$ a complete characterization of optimal product selection and a comparison to the market outcome is more complex than in the case where $u = 0$. In general, when consumers can easily substitute between the two varieties, the bias of the market allocation against the niche variety becomes weaker, and for certain intermediate levels of search costs the market *may* even provide too much of it. However, it can be shown that this situation is not very likely and that, when search frictions are sufficiently weak, a situation similat to that of the previous section occurs, in which the market always under-provides the varieties preferred by minorities.

A planner would still choose ϕ to maximize (2.9) without interfering with the exchange process, since Nash bargaining implements all efficient transactions. However, in contrast to section 2.4.2, he now has to take into account the effects of his choice of ϕ on the equilibrium x_{ij}'s. A detailed solution to the planner's problem is extremely complex and is available on request; here I discuss the main results and intuitions. It can be proven that it is never optimal for a planner to choose $\phi = 0$ or a ϕ such that consumers of type 1 accept their least preferred variety, i.e. at any social optimum $\phi > 0$ and $x_{12} = 0$. The planner is therefore left with a choice between $\phi = 1$ and $\phi < 1$, and in the latter case it has to decide whether a ϕ such that $x_{21} = 1$ or such that $x_{21} = 0$ is optimal. Note that these are the same possible configurations as in the market equilibrium, with the only difference that whereas the transitional phase with $x_{21} = 1$ always exists in a market equilibrium, a planner might find it convenient not to implement such a solution.

One can show that when search frictions are either sufficiently high or suffciently low, the conclusions of section 2.4.2 still apply. When search frictions are sufficiently high mass consumption is the constrained optimal way to employ scarce productive resources and the market 'does the right thing'. When search frictions are sufficiently low, the market tends to under-provide the varieties preferred by small groups of consumers. This owes to the same reasons as in section 2.4: when search frictions are low, consumers tend to be very selective and, given random matching, the expected lifetime utility of any given consumer type is concave in the probability of finding her preferred variety, which gives the central planner scope for increasing expected steady-state welfare by increasing the equilibrium utility of minority types.

However, for intermediate levels of search costs the planner might find it convenient to choose a ϕ that implies $x_{21} = 1$. For example, this always happens for intermediate levels of m if the size of the two groups is not very different or the two varieties are not very differentiated, i.e. if $\sqrt{g}(\sqrt{g} - 1) < u$. If this is the case, then the market under-provides variety 1. The reason for this result is that, when minority consumers accept both varieties, their expected utility becomes linear in ϕ, whereas the utility of type 1 consumers, who are selective, is still concave in ϕ. It turns out that this allows the social planner to increase social welfare by increasing ϕ over and above the market equilibrium.

2.6 Imperfect price discrimination

So far I have considered situations where the producer is always able to recognise the type of the consumer with certainty and charge different prices if profitable, which amounts to allowing for perfect first-degree price discrimination, since a producer always extracts all the surplus that he can (given his bargaining power λ) from every consumer type. Assuming perfect information on the seller's side had two advantages: it simplified the analysis and it allowed me to study the effects of a single well-defined informational problem, namely costly search by consumers. However, in markets where consumers have heterogeneous preferences for a differentiated good this is not the only relevant informational problem, as the imperfect ability of producers to discern the different valuations of heterogeneous consumers for their good may also have important consequences for market outcomes. In this section I study the implications of an increase in such ability for product selection, social welfare, and the realtive welfare of majority and minority consumers.[22]

In contrast to the dynamic setting of sections 2.4 and 2.5, and in order to keep the analysis tractable, in this section I use a simple static model of random matching in which producers have to choose from a continuum of possible product specifications before being randomly matched with a consumer. Upon being matched a producer observes a characteristic of the consumer that he knows to be imperfectly correlated with the consumer's type, after which he charges a price that the consumer can accept or reject, and the game ends. I study how equilibrium product selection, social welfare, and its distribution are affected by changes in the correlation between the observable characteristic and the true

[22] The effects of price discrimination in a monopolistic competition model of random matching are also analysed by Michael Katz (1984). However, he focuses on a situation where consumers have different valuations for a single homogeneous good produced by firms with U-shaped average cost curves. Consequently, his analysis does not address product selection and is rather concerned with efficiency in production and in the allocation of the good to consumers with different demand elasticities.

type of the consumer. I take this correlation to be a good measure of the ability of producers to correctly price discriminate. Although other more general specifications are possible, this model captures in a simple way most of the aspects of the problem that are of interest.[23]

As in the previous sections there is a unit measure of consumers, with a share $\alpha > 1/2$ of them being of type 1 and the rest of type 2, and $g \equiv \alpha/(1-\alpha)$. Each consumer desires to consume only one unit of the good. A good consists of a combination of two measurable attributes, with $\theta \in [0,1]$ representing the share of attribute 1 and $1-\theta$ that of attribute 2 in the composition of the good, so that a variety can be identified with a number $\theta \in [0,1]$. The two types of consumers have idiosyncratic and symmetric preferences over the two attributes, with type 1's satisfaction increasing in θ. In particular, I consider the simple case with linear utility:

$$\begin{aligned} U_1 &= u+\theta-p, \\ U_2 &= u+1-\theta-p \end{aligned} \tag{2.16}$$

where $u > 0$.[24]

On the other side of the market there is a unit measure of producers who, before being matched with a consumer, have to decide irreversibly in which variety θ to specialize. After producers have specialized, they are randomly matched in

[23]In particular, the model could be generalized in two directions. First, in this simple static model there is no competition among producers. A dynamic model that captures the effects of competition on product selection would obviously be more desirable, though much more complex. However, I am confident that the main conclusions of this section would still hold in such a general framework. Second, the ability of producers to price discriminate could be modelled in a different way: whereas here producers always observe the characteristic of the consumer but know that this does not perfectly predict her true type, another possible specification would have perfect correlation between the buyer's characteristic and her true type, but the producer being able to observe this characteristic only with some probability that is less than one. The solution to this alternative model yields the same qualitative conclusions as the model that I use here. However, the model that I use here allows for a more interesting analysis, because producers can decide endogenously when to price discriminate or not.

[24]Assuming linear utility simplifies the analysis substantially because, as I show in Lemma 3 below, it implies that in equilibrium the support of θ is discrete and can take one of only two possible values. Allowing for utility functions that are non-linear in θ would not change the main conclusions of this section but would make the algebra much more cumbersome.

one-to-one pairs with consumers. When a producer and a consumer meet, the producer observes a characteristic $s \in \{1, 2\}$ of the consumer. A consumer of type i has characteristic i with probability $\pi \in [1/2, 1]$: if $\pi = 1/2$ the characteristic is completely uninformative, whereas if $\pi = 1$ the producer gets to know with certainty the type of the consumer. After observing characteristic s, with probability λ a producer carrying product θ has the opportunity to quote a price $p(\theta, s)$ that the consumer can accept, in which case exchange takes place, or reject, in which case no exchange takes place. With probability $(1 - \lambda)$ it is the consumer who has the opportunity to make the offer. After offers have been accepted or rejected the market closes. In this framework π is a good measure of the ability of producers to price discriminate between heterogeneous consumers.

In order to simplify the analysis of the equilibrium, I first establish the following lemmas.

Lemma 2 *A producer with product θ always charges $p(\theta, s) \in \{u+\theta, u+1-\theta\}$.*

Proof. In the Appendix.

This has the following implication for product selection by producers:

Lemma 3 *In equilibrium $\theta \in \{1/2, 1\}$.*

Proof. In the Appendix.

The intuition behind these two lemmas is straightforward. Lemma 2 says that producers do not want to leave any surplus to the marginal group of consumers that they have chosen to target. If a producer with variety θ decides to sell to everybody he charges $\min\{u + \theta, u + 1 - \theta\}$, otherwise he charges $\max\{u+\theta, u+1-\theta\}$ and sells only to high valuation consumers. Lemma 3 says that, if producers decide to sell only to one type of consumers, it will be type 1, the most numerous group, and they will choose the product specification that best suits this type, i.e. $\theta = 1$. If instead they decide to sell to both types, then they will choose the product specification that maximises unit profit margins, and, given the symmetry of the problem, this is that specification that makes both types equally happy, i.e. $\theta = 1/2$.

One can now use these results to determine the equilibrium for any configuration of parameters. I start by analysing the pricing stage, taking $\theta \in \{1/2, 1\}$ as given. Notice that if $\theta = 1/2$ then $p(1/2, s) = u + 1/2$ irrespective of the signal s that the producer observes. Therefore, denoting by $R(\theta)$ the expected revenues of a producer with variety θ, one obtains $R(1/2) = 1/2$. The pricing problem becomes more interesting for a producer that has chosen $\theta = 1$, as he may or may not decide to make the price that he charges, $p(1, s) \in \{u + 1, u\}$ conditional on the consumer's characteristic s that he observes. The decision to price discriminate or not depends on the overall informativeness of the observed characteristic, π, on the relative size of the two groups, g, and on the minimum valuation for the good, u, as shown in the following lemma.

Lemma 4 *In any equilibrium:*

(i) $p(1,1) = u + 1$ *if and only if* $\pi \geq \dfrac{u}{u+g} \equiv \bar{\pi}_1$, *otherwise* $p(1,1) = u$.

(ii) $p(1,2) = u$ *if and only if* $\pi \geq \dfrac{g}{u+g} \equiv \bar{\pi}_2$, *otherwise* $p(1,2) = u + 1$.

Proof. In the Appendix.

Lemma 4 says that, for given π, a producer is more likely to trust characteristic s, and thus make the price charged conditional on its particular realization, if consumers of type s constitute a large share of the population, because if group s is large signal s is more reliable. This can be seen from the fact that as the share of consumers of type 1, and thus g, increases, the threshold of π above which a producer decides to charge $p(1,1) = u + 1$, that is π_1, decreases. Analogously π_2 decreases as the share of type 1 consumers, and thus g, decreases.

It should also be noted that if $u \to \infty$ then $p(\theta, s) = u$ for all θ and s. This is because when u is very large making mistakes is costly for the producer: moving from a price u to a price $u + 1$ would give him a marginal gain of at most 1 but at the risk of losing all the large inframarginal gain u. This suggest that price discrimination is less likely in markets where the good has a very high value for the consumer and is not perceived to be too differentiated. The descriprion of the equilibrium is completed by optimal product choice and is presented in the following proposition.

Proposition 5

(*i*) *For* $g \geq 2u + 1$*:* $\theta = 1$ *for all* π*; if* $\pi \leq \bar{\pi}_2$ *then* $p(1, s) = u + 1$ *for all* s*; if* $\pi \geq \bar{\pi}_2$ *then* $p(1, 1) = u + 1$ *and* $p(1, 2) = u$.

(*ii*) *For* $g \leq 2u + 1$*: if* $\pi \leq \bar{\pi}$ *then* $\theta = 1/2$ *and* $p(1/2, s) = u + 1/2$ *for all* s*; if* $\pi \geq \bar{\pi}$ *then* $\theta = 1$*,* $p(1, 1) = u + 1$*, and* $p(1, 2) = u$*; where* $\bar{\pi} \equiv (2u + g + 1)/2(u + g)$.

Proof. In the Appendix.

This proposition provides some interesting insights regarding the effects of an increase in the ability to price discriminate on product selection, social welfare, and the relative welfare of the two groups of consumers, which will now be discussed in turn.

As regards product selection, when consumers of type 1 constitute a very large share of the population, all producers chose $\theta = 1$, whatever the scope for price discrimination. When the difference in size between the two groups is not too large, however, a substantial increase in the scope for price discrimination causes producers to shift from $\theta = 1/2$ to $\theta = 1$. This happens because without price discrimination producers do not want to risk the relatively large number of type 2 consumers, and therefore choose the "middling" specification $\theta = 1/2$

that they sell to everybody. However, with price discrimination producers can switch to the extreme specifcation $\theta = 1$, lose no demand, and increase their expected profits.

As regards social welfare, I can show that it is increasing in π and that with perfect price discrimination the market outcome is constrained efficient. This is due to the fact that, as discussed in Spence (1976), when the scope for price discrimination increases, social surplus corresponds more closely to firms' profits, and the latter are maximized in equilibrium. Note that, in contrast to section 2.5, where any exchange generating positive surplus was carried out, imperfect price discrimination leads to inefficiencies in pricing and some exchanges with social value may not be effected. Given our assumption of linear expected utility, this is the only inefficiency in this simple static model, since the distribution of surplus among consumers does not matter.[25] By removing this inefficiency, price discrimination achieves constrained efficiency.

Finally, the model sheds some light on the implications of an increase in the producers' ability to price discriminate for the distribution of surplus between majority and minority consumers. When the disproportion in the size of the two groups is very large, i.e. when $g > 2u + 1$, an increase in π above $\bar{\pi}_2$ does not cause any change in the composition of production, since the equilibrium already has $\theta = 1$, but it induces producers to price disciminate, by offering the good at the low price u when they observe $s = 2$. This implies that, whereas type 1 consumers always purchase, and if they are lucky enough to be mistaken for type 2 consumers they obtain some positive surplus, type 2 consumers only purchase if the producer correctly distingushes their type, and even in that case they pay a price exactly equal to their valuation. Formally, using (2.16) and Proposition

[25]Notice how this differs from the model analyzed in sections 2.4 and 2.5, in which there was no inefficiency in pricing, but the market equilibrium was not constrained optimal because the dynamic structure of the model implied that the lifetime utility of individuals was concave in the probability of finding their preferred variety. If one were to set the present model in a dynamic framework, this inefficiency would be added to the pricing inefficiency.

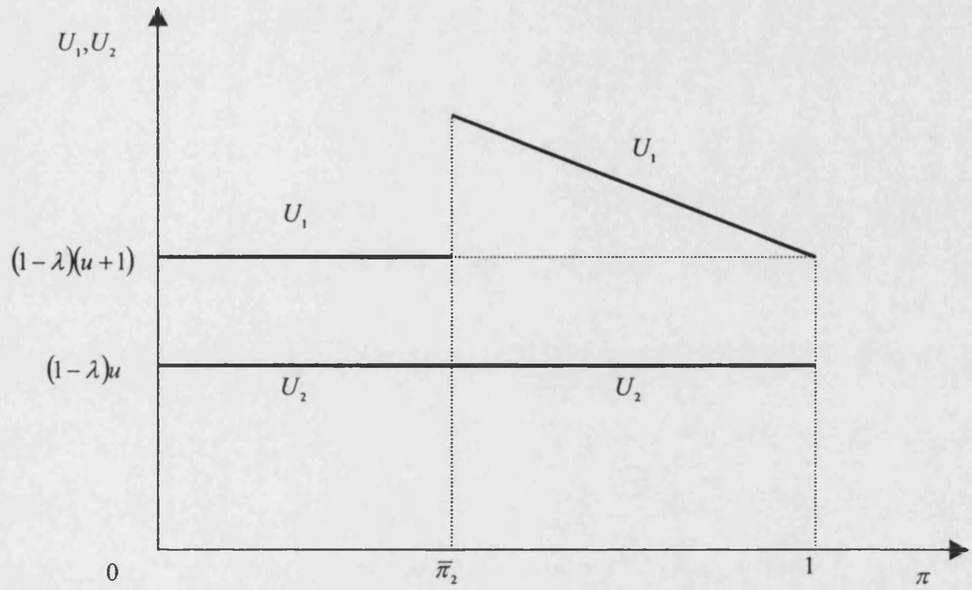

Figure 2.3: Welfare of type 1 and type 2 consumers for $g > 2u + 1$.

5, the expected utility of the two groups of consumers when $g > (2u + 1)$ is

$$\begin{aligned} U_1 &= (1-\lambda)(u+1) + \lambda i_1(1-\pi), \\ U_2 &= (1-\lambda)u, \end{aligned} \tag{2.17}$$

where i_1 is an indicator variable that equals 0 if $\pi \leq \bar{\pi}_2$ and 1 otherwise.[26] Figure 2.3 depicts the evolution of the welfare of the two types of consumers when the producers' ability to price discriminate increases for the case where $g > (2u+1)$. One can see that any $\pi \in (\bar{\pi}_2, 1)$ makes type 1 strictly better off than she is when $\pi < \bar{\pi}_2$. Type 2's welfare is not affected by changes in π.

An increase in π has even more extreme consequences for the welfare of the two types of consumers when the size of the two groups is not very different or when consumers have a very high basic valuation for the good, independently of its variety, i.e. when $g < (2u+1)$. In this case when π is low, all producers choose

[26]The terms $(1-\lambda)(u+1)$ and $(1-\lambda)u$ are due to the fact that the consumer can make the offer with probability $(1-\lambda)$, in which case he offers a price equal to zero, the offer is accepted by the producer and he obtains all the surplus generated by the exchange.

$\theta = 1/2$. However, when π grows above $\bar{\pi}$ it becomes convenient for producers to choose the extreme specification $\theta = 1$ and price discriminate. As already noted above, this means that type 1 consumers alaways purchase and obtain a bargain with probability $(1 - \pi)$, whereas type 2 consumers only purchase if they are charged u and in that case they are left with no surplus. Formally

$$\begin{aligned} U_1 &= \begin{cases} (1-\lambda)(u+1/2) & \text{if } \pi \leq \bar{\pi} \\ (1-\lambda)(u+1) + \lambda(1-\pi) & \text{otherwise,} \end{cases} \\ U_2 &= \begin{cases} (1-\lambda)(u+1/2) & \text{if } \pi \leq \bar{\pi} \\ (1-\lambda)u & \text{otherwise.} \end{cases} \end{aligned} \tag{2.18}$$

Figure 2.4 represents U_1 and U_2 as a function of π for the case where $g \leq (2u+1)$. One can see that an increase in π above $\bar{\pi}$ causes an increase in the the

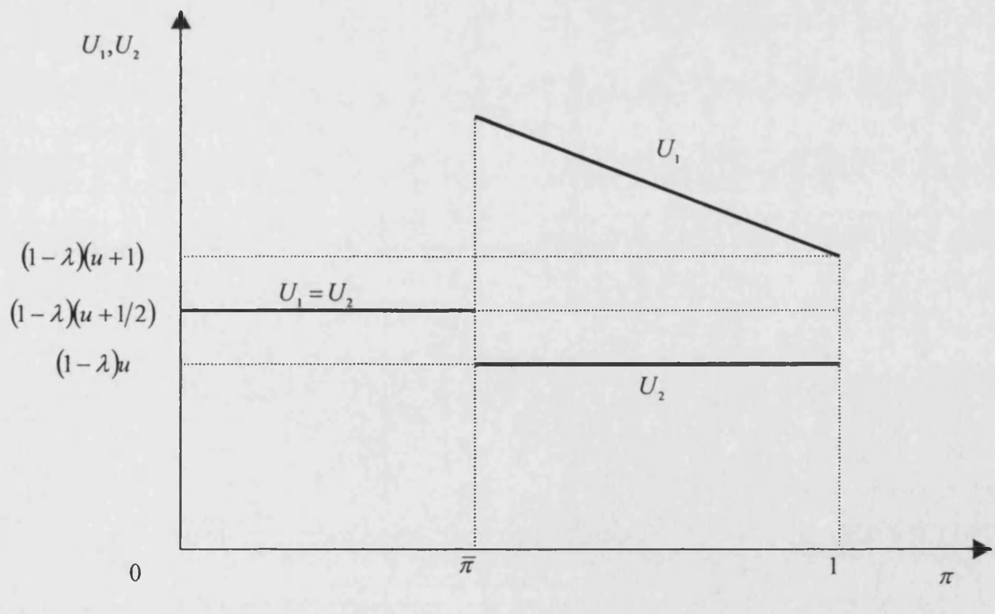

Figure 2.4: Welfare of type 1 and type 2 consumers for $g \leq 2u + 1$.

expected utility of type 1 and, provided that $\lambda < 1$, a decrease in the expected utility of type 2. The changes in the utility of the two consumer types are more dramatic here than when $g > (2u + 1)$, because here they depend not only on the possibility that, owing to imperfect discrimination, type 1 consumers obtain a bargain, but also on the shift in production from $\theta = 1/2$ to $\theta = 1$. Notice that, provided that $\lambda < 1$, type 1 consumers are better off under perfect price discrimination than under no discrimination at all.

Although the analysis presented here confirms that allowing for price discrimination achieves constrained efficiency, it does not confirm the intuition, suggested for example by Paul Krugman,[27] that allowing for price discrimination works in favour of diversified production and in particular of people with peculiar preferences. The reasoning behind this intuition is that if producers were able to distinguish the high valuation of minority consumers for a given variety, the small number of the latter would be less of a serious problem, as revenues might be sufficiently large for the good to be introduced in equilibrium. However, the cogency of this reasoning is substantially weakened when consumers can substitute to some extent between different varieties and producers have incentives to specialize in production. In this case, the possibility of price discrimination can make it more profitable for producers to choose a variety for which many consumers have a high valuation, and to sell that same variety also to everybody else in the market at lower prices, than to specialize in a niche variety, that would be sold at a high price to few people and at a low price to many people.

2.7 Conclusions

This chapter has presented a simple model of a market for a differentiated good where consumers with idiosyncratic preferences constitute different shares of the population and trade is characterized by costly search. The model shows that

[27] *Op. cit.*, see page 52.

the existence of search frictions biases the market outcome in favor of consumers with the same preferences as the majority. In particular, for any positive level of search frictions the equilibrium market share of the variety preferred by the majority is always greater than in the frictionless Walrasian case. If search frictions are sufficiently severe a situation of mass consumption can emerge, in which only the mainstream variety is produced and purchased by everybody. Although there are no increasing returns in the matching process, the model generates scale effects in the composition of the demand base: an increase in the size of a group of consumers with the same preferences leads to a more-than-proportional increase in the production of their preferred variety. This has the effect of benefitting the members of the group that expands, and reducing the welfare of the members of the group that contracts, giving rise to consumption externalities. This bias of the market outcome in favour of the majority becomes weaker when search frictions decrease: the model suggests that the diffusion of the Internet should allow the emergence of markets for specialized goods, redistribute market shares away from top-selling varieties and towards niche varieties,[28] and ultimately benefit consumers with peculiar preferences relatively more than consumers with mainstream preferences. The model also allows a comparison between the market equilibrium and the constrained optimal composition of production. When search frictions are sufficiently severe, the market 'does the right thing', in that mass consumption is constrained optimal. However, when search frictions are sufficiently low, the market tends to under-provide the variety preferred by the minority relative to the constrained optimum. This is because producers do not

[28]Since Sherwin Rosen's (1981) analysis of 'The economics of superstars', an expansion in the size of the market in the presence of indivisibilities in production and of some degree of non-rivalry in consumption is associated with an increase in the concentration of market shares on a few performers or product varieties. According to this line of reasoning, one could think that the Internet, by increasing matching possibilities and therefore the potential size of the market, might accentuate the tendency of some markets to exhibit 'superstardom' effects. However, the theory developed in this chapter suggests that, if the diffusion of the Internet will also substantially reduce search costs, one might observe a rather different outcome where market shares will be more evenly distributed among performers or product varieties.

adequately capture the negative effects of an extremely unbalanced composition of production on expected steady-state consumer surplus.

I then use a simpler and slightly modified version of this model to investigate the consequences of a second informational problem, namely the imperfect ability of sellers to price discriminate. Social welfare is increasing in the sellers' ability to price discriminate. Furthermore, if the two groups of consumers do not differ too much in size, an improvement in the sellers' ability to price discriminate causes a shift in product selection towards the preferences of the majority. This change in the composition of production, together with the existence of costly search, redistributes surplus from minority consumers to majority consumers. This result is strengthened by the fact that, when price discrimination is imperfect, bargains become possible and this can be obtained only by majority consumers.

Appendix

Proof of Proposition 1. I first derive some conditions that an equilibrium must satisfy. This helps to rule out those configurations that cannot constitute an equilibrium. I then derive the equilibrium by construction and easily establish that it is unique for any given parameter configuration.

Note first that $x_{ii} = 1$ whenever the preferred variety of consumer type i is available on the market, i.e. $x_{11} = 1$ whenever $\phi > 0$ and $x_{22} = 1$ whenever $\phi < 1$. The proof is trivial: assume that $x_{ii} = 0$, then (2.12) implies that $V_i \leq u < 1$, which, by part 2 of the definition of equilibrium, contradicts the initial assumption that $x_{ii} = 0$.

Next I establish that $\phi = 0$ cannot be an equilibrium. If $\phi = 0$, then $x_{22} = x_{12} = 1$, and (2.14) implies that the value of a firm specializing in good 2 is $R_2(0) = \alpha p_{12}(0) + (1-\alpha)p_{22}(0)$. The value of a firm specializing in good 1 is: if $m(1-\lambda)(1-u) > u$ then $x_{21} = 0$ and $R_1(0) = \alpha p_{11}(0)$, that can be proved to be strictly greater than $R_2(0)$; if instead $m(1-\lambda)(1-u) \leq u$ then $x_{21} = 1$ and $R_1(0) = \alpha p_{11}(0) + (1-\alpha)p_{21}(0)$, that is obviously strictly greater than $R_2(0)$. I have therefore proven that $\phi = 0$ does not satisfy part 1 of the definition of equilibrium, since for all m we have $R_1(0) > R_2(0)$.

I next prove that $\phi < 1$ and $x_{12} = 1$ cannot be an equilibrium. If $x_{12} = x_{21} = 1$ then (2.14) implies $R_1 - R_2 = \alpha(p_{11} - p_{21}) - (1-\alpha)(p_{22} - p_{21}) = (2\alpha - 1)\lambda(1-u) > 0$, where the second equality follows from (2.13). If instead $x_{12} = 1$ and $x_{21} = 0$ then it can be proved that for $\tilde{\phi}$ such that $R_1(\tilde{\phi}) = R_2(\tilde{\phi})$ part 2 of the definition of equilibrium implies that it cannot be $x_{21} = 0$, since $V_2(\tilde{\phi}) < u$, which contradicts the initial assumption.

Therefore any candidate equilibrium must fall in one of the following configurations: *(i)* $\phi = 1$, *(ii)* $0 < \phi < 1$ and $x_{21} = 1$, *(iii)* $0 < \phi < 1$ and $x_{21} = 0$. I show below that each of these configurations is an equilibrium on some interval of m and that these intervals never overlap, so that the equilibrium is always unique. (i) $\phi = 1$ is an equilibrium if $R_1(1) \geq R_2(1)$, which is the case if and only if $m \leq \bar{m}_1$. (ii) $0 < \phi < 1$ and $x_{21} = 1$ is an equilibrium if $R_1(\phi) = R_2(\phi)$, $V_1(\phi) > u$, $V_2(\phi) < u$, and obviously $\phi \leq 1$. Simple algebra shows that the first equality implies that $\phi = \bar{m}_1/m$; at this value of ϕ the constraint $V_1 > u$ is always satisfied and the constraint $V_2 < u$ is satisfied if and only if $m \leq \bar{m}_2$; this together with the requirement that $\phi \leq 1$ implies that this equilibrium exists if and only if $\bar{m}_1 < \phi \leq \bar{m}_2$. (iii) $0 < \phi < 1$ and $x_{21} = 0$ is an equilibrium if the same constraints as in (ii) are satisfied with the exception that it must now be $V_2(\phi) > u$. It can be shown that the only potentially binding constraint is $V_2(\phi) > u$, that is satisfied if and only if $m > \bar{m}_2$. It is apparent that the intervals of m on which these equilibria are defined are connected, which proves that there always exists an equilibrium and this equilibrium is unique. Q.E.D.

Proof of Lemma 2. First, consider a producer with product $\theta = 1/2$. If he charges $p(1/2, s) > u + 1/2$ he has zero demand, and therefore deviating to any price less than or equal to $u + 1/2$ is optimal. If he charges $p(1/2, s) < u + 1/2$ there exists some $\epsilon > 0$ such that he can increase his profits by charging $p(1/2, s) + \epsilon$. Therefore the only possible equilibrium for $\theta = 1/2$ is $p(1/2, s) = u + 1/2$. Consider then a producer with product $\theta^0 \neq 1/2$. If he charges $p(\theta^0, s) > \max\{u + \theta^0, u + 1 - \theta^0\}$ he has zero demand, therefore charging any price that is less than or equal to $\max\{u + \theta^0, u + 1 - \theta^0\}$ is a profitable deviation. If he charges $p(\theta^0, s) < \min\{u + \theta^0, u + 1 - \theta^0\}$ he sells to both types; therefore there exists some $\epsilon > 0$ such that charging $p(\theta^0, s) + \epsilon$, is a profitable deviation. Finally, if he charges $p(\theta^0, s)$ such that $\min\{u + \theta^0, u + 1 - \theta^0\} < p(\theta^0, s) < \max\{u + \theta^0, u + 1 - \theta^0\}$, then he only sells to the group of consumers with the lowest $|i - \theta^0|$, in which case there exists some $\epsilon > 0$ such that by charging $p(\theta^0, s) + \epsilon$ he looses no demand and increases profits, which constitues a profitable deviation. This proves that in any equilibrium it must be $p(\theta, s) \in \{u+\theta, u+1-\theta\}$. Q.E.D.

Proof of Lemma 3. Consider a producer who has chosen θ^0 such that $1/2 < \theta^0 < 1$. Lemma 2 implies that he will charge $p(\theta^0, s) \in \{u+\theta^0, u+1-\theta^0\}$. If he charges $u+\theta^0$ he sells only to type 1 consumers, therefore there exists some $\epsilon > 0$ such that the producer can increase its profits by choosing $\theta = \theta^0 + \epsilon$ and thus θ^0 is not an optimal product selection. If he charges $u+1-\theta^0$ he sells to both types of consumers, therefore there exists some $\epsilon > 0$ such that the producer can increase his profits by choosing $\theta^0 - \epsilon$ and again θ^0 is not an optimal product selection. An analogous argument can be used to prove that θ^0 such that $0 < \theta^0 < 1/2$ is not an equilibrium. So far we have established that in any equilibrium $\theta \in \{0, 1/2, 1\}$. It remains to be proved that $\theta = 0$ is not an equilibrium. We do so by showing that $\theta = 1/2$ or $\theta = 1$ are always optimal deviations. If for a producer with $\theta = 0$ charging u and selling to everybody is the optimal pricing strategy, then choosing product $\theta = 1/2$, charging $u + 1/2$ and selling to everybody is a more profitable product selection strategy. If instead charging $u+1$ and selling only to type 2 is the optimal pricing strategy, then choosing product $\theta = 1$, charging $u+1$ and selling only to type 1 consumers achieves higher expected profits, as type 1 consumers are more likely to meet than type 2 consumers. This proves that $\theta = 0$ cannot be an optimal product choice and completes the proof. Q.E.D.

Proof of Lemma 4. Denote by $\text{Prob}(t = i|s = j)$, with $i, j = 1, 2$, the probability that a consumer is of type $t = i$ when he has characteristic $s = j$. Using Bayes' rule, we have that

$$\begin{aligned}
\text{Prob}(t = 1|s = 1) &= \frac{g\pi}{g\pi + (1-\pi)} \\
\text{Prob}(t = 2|s = 2) &= \frac{\pi}{\pi + g(1-\pi)}.
\end{aligned}$$

Then (i) follows from the fact that $p(1,1) = u+1$ if and only if $\text{Prob}(t =$

$1|s = 1) \times (u+1) > u$, and (ii) from the fact that $p(1,2) = u$ if and only if $u > \text{Prob}(t = 2|s = 2) \times (u+1) > u$. Q.E.D.

Proof of Proposition 5. Assume $g > 2u + 1$. Since $g > u$, Lemma 4 (i) implies that $p(1,1) = u+1$ for all $\pi \in [1/2, 1]$. Furthermore, if $\pi \leq \bar{\pi}_2$ then Lemma 4 (ii) implies that $p(1,2) = u+1$, thus $\theta = 1$ if and only if $R(1) = \alpha(u+1) > u + 1/2 = R(1/2)$, which is always satisfied for $g > 2u+1$. If instead $\pi > \bar{\pi}_2$ then Lemma 4 (ii) implies $p(1,2) = u$ and $\theta = 1$ if and only if $R(1) = \pi\alpha(u+1) + [\alpha(1-\pi) + (1-\alpha)\pi]u > u + 1/2 = R(1/2)$, that is always satisfied for $\pi > \bar{\pi}_2$ and $g > 2u+1$. This proves the first part of the proposition. Assume then that $g \leq 2u+1$. If $u < g \leq 2u+1$ then arguments analogous to those above establish that $\theta = 1$ if and only if $\pi > \bar{\pi}$, and $\theta = 1/2$ otherwise. If instead $g < u$ then Lemma 4 (ii) implies that $p(1,2) = u$ for all $\pi \in [1/2, 1]$. Furthermore, if $\pi \leq \bar{\pi}_1$ then Lemma 4 (i) implies that $p(1,1) = u$ and thus $\theta = 1/2$ if and only if $R(1/2) = u + 1/2 > u = R(1)$, which is always the case. If instead $\pi \geq \bar{\pi}_1$ then Lemma 4 (i) implies that $p(1,1) = u+1$ and thus $\theta = 1$ if and only if $R(1) = \pi\alpha(u+1) + [\alpha(1-\pi) + (1-\alpha)\pi]u > u + 1/2 = R(1/2)$, that is satisfied for $\pi > \bar{\pi}$. This completes the proof. Q.E.D.

Chapter 3

Globalization and Cultural Diversity: The Economics of the "Cultural Exception"

3.1 Introduction

Among the many heated debates about the consequences of the increasing globalization of the world economy, that focusing on its implications for cultural diversity surely occupies a prominent place in every day conversations and press commentaries. The terms of the debate can be summarized as follows. Many commentators, especially outside the United States, argue that, as a consequence of increasing economic integration, most national markets for cultural goods, such as films, TV shows, books, and music have come to be dominated by products that are typical of the culture of the world's largest national market, namely the United States. Looking at available data for the film industry, it is impossible to deny the truth of this argument. Judith Prowda (1997) reports that, at the beginning of the 1990s, "the United States commanded a staggering 85% of the world's film market, and 90% of the European film market. Of the 100 most attended movies in the world in 1993, eighty-eight were American. By contrast, only 2% of the films released in the United States are of European origin [...]". The conclusion that some European commentators draw is that this state of things is *necessarily* bad for consumers outside the United States and that therefore other countries should be allowed to protect their culture and, with it, their cultural industries.[1] Although these calls for the protection of a country's culture from the consequences of possible market failures may have some merit, the arguments used to support them are often based more on a European intellectual tradition of suspicion towards American culture rather than on sound and impartial logic. In particular these arguments fail to consider one crucial element: if so many Europeans are willing to pay for watching American movies, they must derive at least some utility from them. Therefore an expansion of American productions is not *necessarily* welfare reducing. Furthermore, it would be difficult for an impartial observer not to suspect that the true aim of the French film industry could be to influence the public opinion in order to gather support for a protectionist campaign. In this chapter I show that an argument can indeed made in support of a limited degree of protection of national cultural industries in small, but not too small, countries. In doing so, however, I also expose several weak links in the logic of the advocates of the principle of cultural protecionism at all costs.

Before proceeding with the presentation of the model that underlies my analysis, it is useful to give a brief account of the recent history of the European film industry and of his commercial relations with the United States. In 1989 the debate about globalization and cultural diversity moved from the press and other intelectual circles to the policy arena when the European Union passed the "Television without Frontiers" directive, which required at least 50% of the programs broadcast over European television to be of European origin. In fact, the directive allows individual countries to impose higher quotas, and France has increased this minimum share to 60%, besides imposing an 11% surcharge on all box office receipts and videocassette sales, the revenues of which are redistributed only to French producers. American film producers have opposed very strong resistance to these discriminatory policies, and in 1993 have asked

[1] See, for example, Thomas Bishop (1997).

that they be lifted as part of the GATT protocol on trade liberalization. The European Union, mainly on behalf of France, refused to concede on this point, and after a row that risked jeopardizing the entire round of trade talks, the issue remained unresolved and the provisions of the "Television without Frontiers" directive are still in place today. France's argument in defense of its position is that audio-visual productions are different from other products usually traded in markets, as they constitute an important part of French culture, and that therefore trade protection is necessary as a means of avoiding that increasing globalization jeopardizes cultural diversity. Hence the principle of "cultural exception", on the basis of which France claims the right to protect its audio-visual industry from foreign competition. The fierce row caused by this principle is not surprising if one considers the stakes involved: the film industry is the second most important export sector for the United States, after commercial aerospace, and raised foreign revenues of 9.4 billion dollars in 1994, of which 4.7 billion dollars accrued from European sales alone.

The purpose of this chapter is to use standard economic analysis to shed some light on the main issues in this often confused debate, and, after having done so, to evaluate the merits or flaws of the conclusions drawn and of the remedies proposed by the advocates of trade protection as a means to preserve cultural diversity in the face of globalization. In order to do so, I first propose a simple operational definition of what it means for a product to be typical of the culture of a country. I assume that, although consumers in a given country value variety in itself and derive utility from many different products, they derive more utility from a certain set of products than from others: the products in this set are those typical of this country's culture. This definition implies that, all else equal, consumers in a given country have a preference for varieties which are typical of their country's culture over varities which are typical of other countries' culture, and are therefore made worse off by market forces leading to the predominance of the latter and the progressive disappearance of the former, as claimed by many commentators. However, they also imply that consumers in a given country are willing to substitute away from the former and towards the latter, a feature which is necessary and crucial for the predominance of the culture of large countries to occur but which is often neglected by commentators. Once the possibility of substitution between goods of different cultures is appropriately taken into account, the implications of economic integration for the welfare of consumers in small countries are not as clear-cut, and not necessarily as negative, as some commentators argue. On this simple operational definition of cultural goods, I build a model of international trade which allows me to address in turn the following three questions.

The first step must obviously be a positive analysis of the issue. In particular one needs to establish whether and especially how an increase in economic integration, in the form of a decrease in real trade costs, can lead to the predominance in world markets of products that are typical of the culture of large countries and to the possible disappearance of products that are typical of the culture of small countries in the absence of government intervention. I show below that this outcome is a natural consequence of the "home market effect" (Krugman, 1980), which arises when goods are produced under increasing returns to scale in monopolistically competitive markets, a setting which describes pretty well the kind of industries which are the focus of this chapter. In plain words, the home market effect states that, in the presence of trade costs, a country which has a large market for a given product variety (perhaps because it has a large number of consumers with a strong preference for this variety) will be a net exporter of that variety. This implies that a large country as the USA will export a large amount of its cultural productions and will therefore command a very large share of the world market in these industries. Furthermore, in the particular version of the model that I adopt in this chapter, in which the cultural industry does not employ all the economy's labor, as it co-exists with another numéraire sector, and can therefore expand or contract, the home market effect and the predominance of the products of the large country in world markets become more important as trade costs fall.[2] In the extreme case in which the small country is sufficiently small and trade costs are sufficiently low, the cultural industry of the small country can be completely swept away by economic integration.

Second, does the fact that economic integration decreases provision of the varieties preferred by the consumers in the small country necessarily implies that the latter are made worse off? The answer to this question is obviously no, since a fall in real trade costs also implies an increase in the resources that consumers have available for purchase of cultural varities, which clearly has a positive effect on their welfare. Given the particular structure of my model I can in fact derive the stronger result that the latter positive effect always dominates the former negative effect and consumers in the small country are always made better off by a fall in real trade costs.

Finally, can the small country benefit from a trade regime that allows it to impose tariffs, or other protective measures, on imported cultural varieties? The answer to this question is yes, provided that the country is not too small. Note that trade protection, just as real trade costs, influences the composition of cultural production in favor of the small country, but its effects on the domestic consumers' disposable income and on the optimality of the allocation of consumption differ from those of real transport costs. Contrary to an increase in real transport costs, the imposition of tariffs, provided that tariff revenues are entirely redistributed, does not affect the consumers' disposable income. However, the imposition of an import tariff introduces a wedge between the relative prices of imported and domestic varieties and their true relative social costs,

[2] I will discuss towards the end of this introduction the main differences between the home market effect as it operates in the present model and as it operates in Krugman (1980).

which leads to a potentially important consumption distortion. Therefore, by levying a tariff on imported varieties a country can increase the production of varieties typical of the domestic culture at the cost of introducing a consumption distortion at the margin. If the country is not-too-small, the tariff needed to achieve the first objective is not too high, and its benefits can offset the small social costs of the consumption distortion that it causes. However, if a country is very small, the tariff needed to achieve the first purpose would be vey high, implying a very strong consumption distortion and making free trade optimal. The importance of country size in determining the optimal solution to this trade-off, which will be made more precise in the rest of the chapter, can explain why a policy of cultural protectionism can make sense for a relatively large country like France, but would be detrimental for small countries like Sweden, Denmark, Norway, and the Netherlands, that have historically chosen to completely open their television, film, and book markets to American and English products.

The remainder of this chapter is in five sections. Section 3.2 gives a brief account of related literature. Section 3.3 sets out the model and Section 3.4 presents its solution in the case in which there are real transport costs and no government intervention. Section 3.5 analyzes trade protection. Section 3.6 concludes.

3.2 Related Literature

In this section I briefly clarify how the model presented in this chapter relates to the existing literature. The setting of my model is standard in the international trade literature and is very closely related to Krugman (1980), from which, however, it differs in on important respect. Krugman's model has a unique monopolistically competitive sector, in which the quantity produced by each single active firm, and thus the indirect labor demand of each single firm, depends only on the elasticity of demand and on technology, and is independent of transport costs. Full employment of labor implies therefore that the number of varieties produced in each country is completely independent of the level of transport costs. A change in transport costs has the only effect of determining changes in the real wages of the two countries. In my model, the monopolistically competitive sector co-exists with a perfectly competitive sector producing under constant returns to scale. This implies that the monopolistically competitive sector in each country, and the number of varieties produced therein, can expand or contract in response to changes in transport costs; whereas the real wage in each country, at least when computed in terms of the numéraire good, is independent of transport costs. The latter seems to be a more appropriate framework to study the issues at hand, as I am interested on the effects of globalization on the composition of cultural production and as the level of employment in the cultural industries under consideration is unlikely to have major effects on national wages. A second advantage of the setup adopted in this chapter is that it assumes away the well-known effects of tariffs on the terms of trade and allows me therefore to focus exclusively on a different mechanism through which a limited degree of trade protection can improve the welfare of a country.

The normative analysis in this chapter, and especially the determination of the optimal tariff, is also related to Venables (1982), who studies the optimal trade policy for a country with an import-competing monopolistically competitive industry. However, whereas Venables considers a small country and remains agnostic on the way in which trade policy in this country affects the number of foreign varieties, I consider a general equilibrium model of the world economy in which the composition of production is endogenously determined by the characteristics and policies of two large countries.[3]

[3]Large is used here in the usual way in which it is used in Economics, meaning that the actions of each country can affect the equilibrium in the other country. However, throughout the chapter, the fact that one of these two 'large' countries is, possibly much, smaller than the other plays a crucial role.

3.3 The model

The world economy is composed of two countries, A and B. Country A is the large country, with a population of N agents, and country B is the small country with a population of gN agents, $0 < g < 1$. In each country every agent is endowed with two units of labor, which is the only factor of production, so that the total labor force in country A and B is $L^A = 2N$ and $L^B = 2gN$, respectively.

3.3.1 Cultural goods and preferences

Agents can consume a numéraire good Y and a continuum of varieties of a cultural good, where j denotes a particular variety and n the total number of varieties available for consumption. The quantity of Y consumed by an agent of country i is denoted by y_i and the quantity of each variety j consumed by an individual agent of country i is denoted by $x_i(j)$. Based on some common, and not explicitly modelled, characteristics, the varieties of the cultural good can be assigned to either of two sets $\mathcal{A}$ and $\mathcal{B}$. For example, if the cultural industry under consideration is the film industry, one can think of $\mathcal{A}$ as containing all action films and of $\mathcal{B}$ as containing all introspective or psychologycally dramatic films. The number of varieties in $\mathcal{A}$ is denoted by n_A and the number of varieties in $\mathcal{B}$ is denoted by n_B. The subscript $k \in \{A, B\}$ in $x_{ik}(j)$ is used to denote the set to which a given variety j belongs, e.g. $x_{iA}(j)$ is the consumption of variety j by a consumer of country i if $j \in \mathcal{A}$. In order to define a variety that belongs to set $\mathcal{A}$ as typical of the culture of consumers in country A, I still need to introduce a preference relation according to which consumers in country A derive more utility from consuming a variety of type $\mathcal{A}$ than from consuming a variety of type $\mathcal{B}$. I do so by assuming that consumers in country i maximize the following utility function

$$U_i = \log y_i + \log\left(\int_0^n a_{ik} x_{ik}{}^{\theta}(j)\mathrm{d}j\right), \tag{3.1}$$

subject to $$p_Y y_i + \int_0^n p_i(j) x_{ik}(j)\mathrm{d}j = 2w_i,$$

$$p_Y y_i + \int_0^n p_i(j) x_{ik}(j)\mathrm{d}j = 2w_i, \tag{3.2}$$

where $a_{ik} = a > 1$ if $i = k$, $a_{ik} = 1$ if $i \neq k$, and $0 < \theta < 1$. Furthermore, w_i is the wage of an agent in country i, and $p_i(j)$ is the price that she pays for one unit of variety j.

This utility function implies that consumers of country A (B) value cultural variety in itself, but attach higher utility to varieties that are in the cultural set $\mathcal{A}$ ($\mathcal{B}$). One can therefore define $\mathcal{A}$ ($\mathcal{B}$) as the set of goods that are typical of the culture of country A (B). Note that until now I have not yet specified anyhthing about the country where this varieties are produced, as the location of production will be derived endogenously in equilibrium. At this stage, a variety j can be considered typical of the culture of country A if, all else equal, it appeals more to consumers of country A than to consumers of country B, irrespectively of where it is produced.

3.3.2 Production and market structure

The numeréraire good Y can be produced with a constant returns to scale technology with unit input-output coefficient, is sold on a perfectly competitive market, and can be traded at no transport cost between the two countries. The price of good Y is normalized to one; this implies that, provided that some positive quantity of Y is produced in both countries, as will be the case in equilibrium, the wage rate is equalized between countries and is equal to unity. As for the cultural goods sector, each variety can be produced with the same increasing returns to scale technology, which requires a fixed cost of F units of labor, independently of the quantity produced, and a marginal cost of c units of labor per unit produced. I further assume that each producer regards itself as too small for its pricing decision to have an impact on consumers' purchasing power and therefore that the market structure is monopolistic competition with large numbers. The total quantity produced of a given variety j will be denoted by X_j. Varieties of the cultural good can be traded between the two countries at some trade cost. I assume that this trade cost is of the "iceberg" type: $\tau > 1$ units of a given variety must be shipped from one country for one unit to arrive in the other country. Therefore higher values of τ correspond to higher transport costs. Throughout the model, I will use a superscript to denote the country in which a variety is produced, with x_{ik}^s denoting the quantity of a given variety of type k produced in country $s \in \{A, B\}$ which is consumed by a resident of country i, X_k^s denoting the total quantity produced by a firm that specializes in a variety of type k and is based in country s, and n_k^s the total number of varieties of type k produced in country s.

As an anticipation of the equilibrium results, it should be noted that country A, the large country, will be a *net* exporter of cultural goods and a *net* importer of food. This will also imply that national labor supplies will not be sufficient to pin down the number of varieties of cultural goods produced by each country, but that this will depend on the characteristics of demand, the relative size of the two countries and on transport costs.

3.4 Equilibrium with transport costs

Given the Cobb-Douglas form of the utility function in (3.1), we can use a two-stage utility maximization procedure to solve for the consumer problem. Consumers will allocate half of their income to the numéraire good and half to cultural goods. Therefore one can restrict attention to their maximizing the second term in the right hand side of (3.1) with a disposable income equal to one, given that each consumer has a total income equal to two and spends half of it on cultural goods.

Note that the elasticity of demand as perceived by producers is $\sigma \equiv \frac{1}{1-\theta} > 1$ in both markets and is independent of any other parameter of the model. Every producer therefore charges the optimal (mill) price

$$p = \frac{\sigma}{\sigma - 1}\, c\, w = 1, \tag{3.3}$$

where the last equality follows from the fact that equilibrium wage rates are equal to unity in both countries and that, by way of normalization, I choose units of measurement for output so that $c = \frac{\sigma-1}{\sigma}$. Given this optimal pricing startegies, equilibrium profits for each producer are given by

$$\pi_k^s = \frac{X_k^s}{\sigma} - F. \tag{3.4}$$

A producer of a variety of type k in country s will be active in equilibrium if and only if $\pi_k^s \geq 0$, which is the case if and only if $X_k^s \geq \sigma F$. In a free entry equilibrium positive profits would be eroded by new entrants and we must have that $X_k^s \leq \sigma F$ for all $s, k \in \{A, B\}$. Making use of these two conditions we have that in equilibrium $n_k^s > 0$ if and only if $X_k^s = \sigma F$ and $n_k^s = 0$ if and only if $X_k^s < \sigma F$. To see what this implies for the computation of the equilibium of the model, one needs to express X_k^s in explicit form for all k and s

$$\begin{aligned} X_A^A &= \left(x_{AA}^A + \tau g x_{BA}^A\right) N, \\ X_B^A &= \left(x_{AB}^A + \tau g x_{BB}^A\right) N, \\ X_B^B &= \left(\tau x_{AB}^B + g x_{BB}^B\right) N, \\ X_A^B &= \left(\tau x_{AA}^B + g x_{BA}^B\right) N. \end{aligned} \tag{3.5}$$

At the optimum consumption plan, the marginal rate of substitution between any two varieties equals their relative price. In particular, for any $i, k \in \{A, B\}$,

$i \neq k$, we have

$$x_{ik}^i = a^{-\sigma} x_{ii}^i \quad \text{and} \quad x_{ik}^k = (a\tau)^{-\sigma} x_{ii}^i. \tag{3.6}$$

We can use (3.5) and the relationships in (3.6) to write the free entry conditions as

$$\begin{aligned}
X_A^A &= \left(x_{AA}^A + a^{-\sigma}\tau^{1-\sigma} g x_{BB}^B\right) N \leq \sigma F, \qquad (n_A^A \geq 0), && (3.7)\\
X_B^A &= \left(a^{-\sigma} x_{AA}^A + \tau^{1-\sigma} g x_{BB}^B\right) N \leq \sigma F, \qquad (n_B^A \geq 0), && (3.8)\\
X_B^B &= \left(a^{-\sigma}\tau^{1-\sigma} x_{AA}^A + g x_{BB}^B\right) N \leq \sigma F, \qquad (n_B^B \geq 0), && (3.9)\\
X_A^B &= \left(\tau^{1-\sigma} x_{AA}^A + a^{-\sigma} g x_{BB}^B\right) N \leq \sigma F, \qquad (n_A^B \geq 0); && (3.10)
\end{aligned}$$

where the constraint to which the complemenatry slackness condition applies is shown in parentheses at the right of each free entry condition.[4]

The four rows of the left hand side of inequalities (3.7)-(3.10) are linearly independent for $g < 1$ and $a, \tau > 1$. This means that for any pair (x_{AA}^A, x_{BB}^B) which constitutes a solution of this system, at most two of the four free entry conditions above can hold with equality. It can be shown that it will always be the case that $n_A^B = 0$ and $n_B^A = 0$, that is a country never specializes in the varieties typical of the culture of the other country.[5] Therefore if a variety typical of a given culture is produced at all, it is produced in the country where this culture is dominant. This means that I can focus attention on $n_A^A > 0$ and

[4]Note that, although we chose to express the free entry condition in terms of x_{AA}^A and x_{BB}^B for future conveniency, we could have expressed them in terms of any other pair $\{x_{Ak}^s, x_{Bk}^s\}$ for any $k, s \in \{A, B\}$.

[5]The proof of this fact, the tedious details of which are omitted here, can be summarized as follows. Consider the equilibrium conditions (3.7) - (3.10) and the relationships implied by (3.6). If in equilibrium $n_A^B > 0$ or $n_B^A > 0$, and thus if (3.8) or (3.10) held with equality, then at least one of the other inequalities would be violated, which contradicts the initial assumption that this indeed an equilibrium. Therefore it must be the case that $n_A^B = 0$ and $n_B^A = 0$. Intuitively this is the case because it is clearly more profitable to produce a variety of type $\mathcal{A}$ in country A than in country B, and a variety of type $\mathcal{B}$ in country B than in country A.

$n_B^B \geq 0$.[6] I will now show that, for sufficiently high transport costs, the unique equilibrium of the model has some production of varities belonging to both $\mathcal{A}$ and $\mathcal{B}$ (i.e., that $n_A^A > 0$ and $n_B^B > 0$), whereas for sufficiently low transport costs, only varieties in $\mathcal{A}$ are produced (i.e., that $n_A^A > 0$ and $n_B^B = 0$).

Assume that $n_A^A > 0$ and $n_B^B > 0$, so that (3.7) and (3.9) hold with equality. We can use (3.7) and (3.9) together to find the individual consumption levels x_{AA}^A and x_{BB}^B in this equilibrium

$$x_{AA}^A = \frac{\sigma F}{N}\frac{1}{1+a^{-\sigma}\tau^{1-\sigma}}, \tag{3.11}$$

$$x_{BB}^B = \frac{\sigma F}{gN}\frac{1}{1+a^{-\sigma}\tau^{1-\sigma}}. \tag{3.12}$$

These individual consumption levels can then be used in the budget constraint of consumers to back out the equilibrium number of varieties of the two types. Taking into account that $w_i = 1$ and that $p_Y y_i = 1$, the budget constraints specified in (3.2) can be written as

$$n_A^A x_{AA}^A + n_B^B \tau x_{AB}^B = 1,$$

$$n_A^A \tau x_{BA}^A + n_B^B x_{BB}^B = 1.$$

which, using (3.6), becomes

$$(n_A^A + a^{-\sigma}\tau^{1-\sigma} n_B^B) x_{AA}^A = 1, \tag{3.13}$$

$$(a^{-\sigma}\tau^{1-\sigma} n_A^A + n_B^B) x_{BB}^B = 1. \tag{3.14}$$

Using (3.11), (3.12), (3.13), and (3.14) together I obtain

$$n_A^A = \frac{N}{\sigma F}\frac{1-ga^{-\sigma}\tau^{1-\sigma}}{1-a^{-\sigma}\tau^{1-\sigma}}, \tag{3.15}$$

$$n_B^B = \frac{N}{\sigma F}\frac{g-a^{-\sigma}\tau^{1-\sigma}}{1-a^{-\sigma}\tau^{1-\sigma}}. \tag{3.16}$$

[6] In equilibrium it must be the case that n_A^A is strictly positive, because if $n_A^A = 0$ then $n_B^B = n_A^B = n_B^A = 0$, which contradicts utility maximization by consumers.

In this equilibrium, the total number of varieties, $n = n_A^A + n_B^B$, is independent of the level of the transport cost τ and of the preference parameter a and is given by[7]

$$n = n_A^A + n_B^B = \frac{(1+g)N}{\sigma F}. \tag{3.17}$$

From (3.16) it is clear that an equilibrium with $n_B^B > 0$ only exists if $\tau \geq \tilde{\tau}$, where

$$\tilde{\tau} \equiv \max\left\{(ga^{\sigma})^{1/(1-\sigma)}, 1\right\}.$$

If $\tau \leq \tilde{\tau}$, the equilibrium has $n_B^B = 0$ and $n_A^A = n$, where n is given by (3.17).[8] Figure 3.1 shows how the share of the varieties typical of the culture of the small country in the total world production of the cultural industry depends on the level of trasport costs. Starting from high levels of τ an increase in economic integration, in the form of falling trade costs, decreases the number of varieties typical of the culture of country B and increases the number of varieties typical of the culture of country A. If the size of the two countries is sufficiently different or the preference for own culture is not too strong, i.e. if $g < a^{-\sigma}$ and therefore $\tilde{\tau} > 1$, there exists a threshold level of transport costs below which the entire world market for the cultural good is taken over by the varieties typical of the culture of the large country, and the small country completely specializes in the production of the numéraire good. [9] However, the

[7]This is because half of the labor force in the world is used to produce the numeraire good and half to produce the cultural varieties. Since the structure of our model implies that the quantity produced by each active firm, and therefore its labor demand, is independent of transport costs and of the preference paramemter a, so must be the total number of varieties produced in the world.

[8]Note that if the two countries are not too different in size or if the preference for own culture is sufficiently strong, so that $g > a^{-\sigma}$, the share of varieties typical of the culture of the small countries, n_B^B/n, is always positive.

[9]Note that results similar to those depicted in Figure 3.1 would obtain even if there were no difference in the culture of the two countries, i.e. if $a = 1$, although in this case varieties would only be disinguished by the location in which they are produced. However, the fact that $a > 1$ introduces interesting considerations for the welfare of the small country, which will be addressed below.

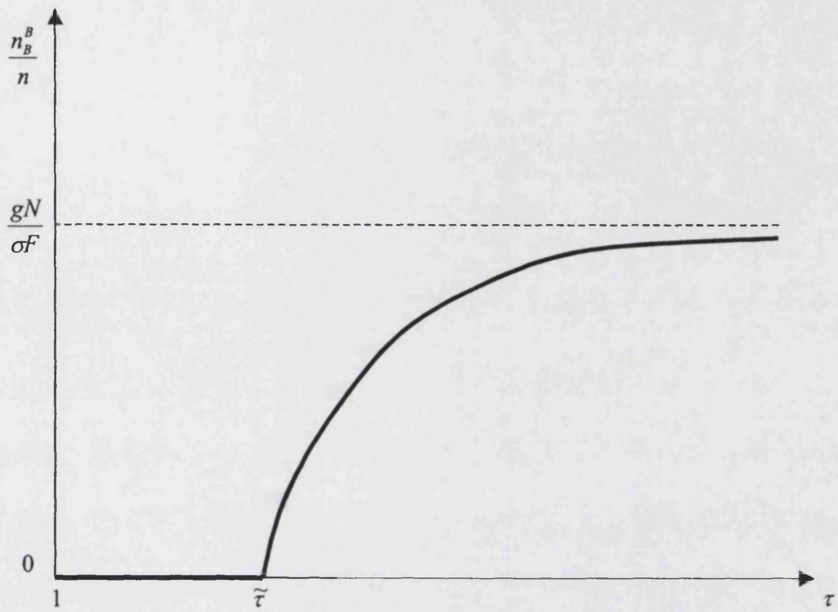

Figure 3.1: Share of B varieties in world cultural production.

fact that globalization reduces the provision of varieties that are typical of the culture of the small country does not necessairly mean that this country is made worse off, as many commentators seem to imply. In the context of this model an increase in economic integration has two opposite effects on the welfare of consumers in the small country. On the one hand it changes the composition of cultural provision in an unfavorable way, since it reduces availability of their preferred varieties and increases the availability of varieties that they value less. On the other hand, a decrease in real transport costs, which in this section are a net social loss, favors consumers, as they have more resources to spend on any good. The net effect of a fall in τ on the welfare of consumers in country B can be evaluated by computing their indirect utility

$$V_B(\tau, g, a) = \begin{cases} a\left[\dfrac{N(1+a^{-\sigma}\tau^{1-\sigma})}{\sigma F}\right]^{1/\sigma} & \text{if } \tau > \tilde{\tau} \\ \left[\dfrac{N(1+g)\tau^{1-\sigma}}{\sigma F}\right]^{1/\sigma} & \text{otherwise,} \end{cases} \tag{3.18}$$

It is straightforward to verify that the welfare of consumers in the small country always increases as a consequence of a decrease in transport costs, since $\sigma > 1$. In this model the direct welfare gain due to a decrease in wasteful trade costs always offsets the indirect negative welfare effect that the latter has by causing a decrease in the production of $\mathcal{B}$ varieties. However, the next section shows that if economic integration takes the form of a reduction in trade protection instead of a decrease in real transport costs, this strong result is not warranted anymore, since the small country could experience welfare losses from integration.

3.5 Trade protection

In the previous section an increase in the degree of economic integration necessarily benefited the small country, because it was associated with a reduction in real transport costs. However, this section shows that some degree of trade protection, in which tariff revenues are redistributed to consumers, can increase the welfare of the small country by encouraging production of a sufficiently large number of varieties typical of its culture. Trade protection is more likely to increase welfare in the small country if this country is not too small and if preference for own culture is very strong. In what follows I consider the symmetric case in which both countries impose the same ad valorem tariff of $(t-1)\%$ on each imported unit, so that, given that equilibrium f.o.b. prices are equal to one, consumers in each country have to pay a price $t > 1$ on each imported unit.[10]

[10] I limit my analysis here to the symmetric case for simplicity. The case in which only the small country imposes a tariff yields a more complicated and less realistic solution, as in this case any positive tariff level would cause the small country to completely specialize in the production of cultural goods and would affect the terms of trade, by raising the wage rate in

The solution of the model with trade protection is similar to the solution of the model with transport costs presented in the previous section. In particular, the equilibrium is characterized by equations (3.3) through (3.16) where $t^{-\sigma}$ should be substituted for $\tau^{1-\sigma}$ everywhere. However, changes in the tariff rate t have a different effect from changes in the real transport cost τ on consumers welfare as they do not entail direct net losses or gains in productive resources, but introduce a wedge between the relative prices of different varieties as perceived by consumers and their true relative social costs. More precisely, both changes in transport costs and in tariff rates affect the shares of varieties of type $\mathcal{A}$ and $\mathcal{B}$ in the market. Futhermore transport costs decrease the purchasing power of consumers, as can be seen in equations (3.13) and (3.14), but do not entail any distortions at the margin of the quantity consumed, as the relative price of an imported variety and a domestic variety, τ is equal to their relative social cost. On the contrary, tariff rates do not affect the purchasing power of consumers, as their revenue is entirely redistributed for the purpose of consumption of cultural variety, but make the price of imported varieties relative to domestic varieties, t, greater than their relative social cost, which is equal to one, causing consumers to consume too little of them. The total effect on the welfare of consumers in the small country B of a change in the bilateral tariff rate t depends on the balance between the positive effect on the composition of production and the negative effect of the distortion at the margin of the quantities consumed. To evaluate the relative strength of these two effects one needs to consider the equilibrium indirect utility of consumers in country B, which is given by

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the small country. The symmetric case considered here therefore rules out any terms-of-trade motive for an optimal tariff, and focuses only on the effects that the bilateral tariff has on the composition of production and the allocation of consumption. This special case could be interpreted as the level of bilateral trade protection, if any, that a small country (e.g. France) should try to obtain in trade negotiations (e.g. the 1993 GATT protocol) with larger countries (e.g. the USA).

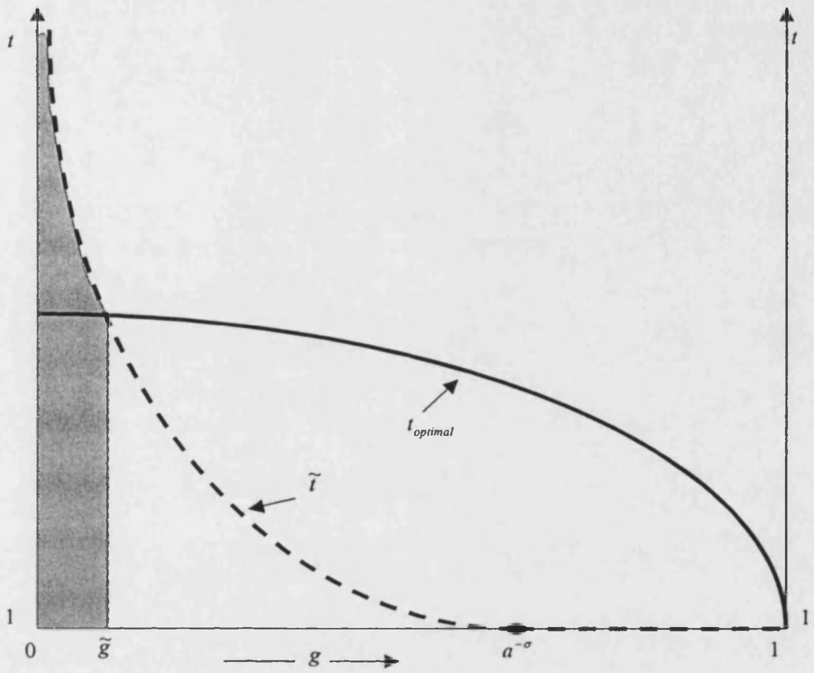

Figure 3.2: Optimal tariff for small country B.

$$V_B = \begin{cases} a\left[\dfrac{Ng(1+(at)^{-\sigma})}{\sigma F}\right]^{\frac{1}{\sigma}} \times \\ \qquad \left[\dfrac{1-a^{-2\sigma}t^{1-2\sigma}+g^{-1}(t-1)(at)^{-\sigma}}{1-(at)^{-2\sigma}}\right] & \text{if } t > \tilde{t} \\ \left[\dfrac{N(1+g)}{\sigma F}\right]^{\frac{1}{\sigma}} & \text{otherwise,} \end{cases} \tag{3.19}$$

where $\tilde{t} \equiv (ga^{\sigma})^{-1/\sigma}$.

Although few general results can be computed in closed form, in what follows I rely on simulations to characterize the main results of this section. Figure 3.2 provides a graphical characterization of the optimal tariff for any given size $g < 1$ of the small country. The first thing to notice is that, as shown in the second line of (3.19), in order to affect welfare at all the tariff must be binding, i.e. it must be sufficiently high to prevent the disappearance of the cultural industry in the small country. The dahsed line in Figure 3.2 represents, for any given level of g, the threshold level $\tilde{t}$ of t above which $n_B^B > 0$ and below which $n_B^B = 0$. Notice that tariff levels below $\tilde{t}$ have no effect on welfare, because they do not affect the consumers' choice between imported and domestic varieties, since the latter are not available. Also note that smaller countries would need higher levels of protection in order to affect the composition of production at all and therefore their consumers' welfare. The solid line in Figure 3.2 depicts the optimal tariff level, for any given g, *on the assumption that* $n_B^B > 0$. However, for sufficiently small g, the tariff level represented by the solid line is inconsistent with the assumption that $n_B^B > 0$, since it lies below the dashed line. The optimal tariff level as a function of g is therefore represented by the solid line in Figure 3.2, provided that this lies above the dashed line, i.e. provided that $g > \tilde{g}$. One can see that the optimal level of protection increases as country size decreases up to the threshold size $\tilde{g}$, below which any tariff level in the shaded region is optimal and not binding, implying that effectively undistorted trade is optimal. The intuition behind this result is as follows. If a very small country wanted to improve the welfare of its consumers by promoting production of varieties typical of the country's culture, it would have to levy a very high tariff. The consumption distortion implied by this high tariff may however be so great, that the country would maximize welfare by allowing free trade. This result is interesting, as it could explain why relatively large countries like France embrace a very active trade policy on cultural products, whereas small countries like the Scandinavian countries and the Netherlands have historically had a laissez-faire attitude towards the import of foreign, and especially American, cultural products.

It should also be noted that country A, the large country, always loses from bilateral protection, as this would not only introduce a consumption distortion but would have the additional negative effect of affecting unfavorably the composition of cultural production.[11] This might explain why the United States are so strongly opposed to the "cultural exception" principle that excludes audio-visual material from trade liberalization agreements.

It is important to notice that in this model the argument for the welfare improving adoption of trade protection by a not-too-small country hinges crucially on a being strictly greater than one, i.e. on the existence of a need for cultural diversity, and on the asymmetry in size between countries, i.e. on g being strictly less than one. For $a = 1$ bilateral free trade is always optimal for the small country. This is because, when $a = 1$, the composition of production between type $\mathcal{A}$ and type $\mathcal{B}$ products becomes irrelevant for consumers. Therefore a positive tariff would have the only negative effect of introducing a wage between relative prices and true relative social costs of imported and domestic varieties. Similarly, even if $a > 1$, bilateral free trade is optimal for both countries when $g = 1$. This can be seen from equations (3.15), (3.16), and (3.17), which for $g = 1$ imply $n_A^A = n_B^B = N/\sigma F$ for all τ (or, in the notation of this section, for all t). Therefore, in the case of countries of equal size, levying a positive tariff would not affect the composition of cultural production (which is the only possible source of gains from protection in this model) but would still introduce a consumption distortion at the margin, damaging both countries.

3.6 Conclusions

This chapter has presented a two-country model of international trade in which consumers derive some utility from product varieties that are typical of the culture of the other country but, all else equal, prefer product varieties that are typical of the culture of their own country. All varieties are produced with the same increasing returns to scale technology in a monopolistically competitive

[11]However, in an imperfectly competitive setting like the present one, saying that the large country prefers bilateral free trade is not the same as saying that it would prefer unilateral trade liberalization in the face of trade protection by the small country.

market and can be traded, possibly at some cost, between the two countries. This model has been used to analyze the effects of globalization, in the form of a decrease in trade costs, on cultural diversity and on the welfare of consumers, especially of those in the small country. The results of the model show that globalization can indeed decrease cultural diversity, but that this might not, and in this instance does not, impose a welfare loss on consumers in the small country. The model also shows that a small positive tariff can improve the welfare of a small country, provided that this country is not too small.

I feel that the analysis outlined in this chapter can help shed some light on a much debated issue, which is at the forefront of the political debate in France and is receiving considerable attention also in other countries. If French consumer really value their cultural products substantially more than American products, the French government might actually be right to protect their market from imports of the latter, as the free trade equilibrium involves an externality which causes French varieties to be under-supplied. Obviously, it is difficult to know whether current levels of protection are optimal or eccessive, and there is no way to check whether this alleged preference of the the French people, and not only of French élites, for French films is actual or if it is a pretext used by the very vocal French film industry to secure protecion.

One should also notice that in the model of this chapter cultural goods have been treated as private goods, the consumption of which only benefits the individual who purchases a given good. An argument can be made, and has indeed been made by the French, that there is some aspect of public good to cultural consumption. The showing of a French film can not only provide entertainement to the viewer who is paying the admission ticket or the price of the video-cassette, but can also help preserve the vitality of French language and culture, an aspect that neither viewers nor producers are likely to take into account when taking their decisions. The public good nature of cultural productions would therefore lead to underprovision of cultural goods, and could constitute another reason for government intervention. However, one should notice that the public good argument for government intervention is valid also in autarky, and it is not clear at all how international trade in itself would make the underprovision of cultural goods with respect to the optimum a more serious problem and therefore government intervention more desirable. This aspect of the issue has not been considered in this chapter and seems to constitute an interesting extension of the model presented here.

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